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(33) 優先権主張国 日本 (J P)

(71) 出願人 000131810

株式会社ジエイエスピー

東京都千代田区内幸町2-1-1 飯野ビル

(72) 発明者 森田 和彦

栃木県鹿沼市さつき町10-3 株式会社ジエイエスピー鹿沼研究所内

(72) 発明者 室井 崇

栃木県鹿沼市さつき町10-3 株式会社ジエイエスピー鹿沼研究所内

(74) 代理人 100077573

弁理士 細井 勇

最終頁に続く

(54) 【発明の名称】 ポリオレフィン系樹脂積層発泡体

(57) 【要約】

【課題】 成形直後から十分な帯電防止効果を有し、洗浄によって帯電防止効果が損なわれることがなく、リターナブルな用途に使用可能な積層ポリオレフィン系樹脂発泡体及び十分な強度を有する積層ポリオレフィン系樹脂発泡体を提供することを目的とする。

【解決手段】 本発明のポリオレフィン系樹脂積層発泡体は、ポリオレフィン系樹脂発泡シートの少なくとも片面に合成樹脂層が積層されてなる積層発泡体において、該合成樹脂層が最外層にポリオレフィン系樹脂層を有する1層以上のものであり、該ポリオレフィン系樹脂層には表面固有抵抗が 1×10^{13} (Ω/\square) 以下となるようにポリマータイプの帯電防止剤が含有されていることを特徴とする

【特許請求の範囲】

【請求項1】 ポリオレフィン系樹脂発泡シートの少なくとも片面に合成樹脂層が積層されてなる積層発泡体において、該合成樹脂層が最外層にポリオレフィン系樹脂層を有する1層以上のものであり、該ポリオレフィン系樹脂層には表面固有抵抗が 1×10^{13} (Ω/\square) 以下となるようにポリマータイプの帯電防止剤が含有されていることを特徴とするポリオレフィン系樹脂積層発泡体。

【請求項2】 ポリオレフィン系樹脂発泡シートの少なくとも片面に合成樹脂層が積層されてなる積層発泡体において、該合成樹脂層が最外層にポリオレフィン系樹脂層を有する1層以上のものであり、該ポリオレフィン系樹脂層には、エタノールによる超音波洗浄後の表面固有抵抗が $1 \times 10^8 \sim 1 \times 10^{13}$ (Ω/\square) となるように帯電防止剤が含有されていることを特徴とするポリオレフィン系樹脂積層発泡体。

【請求項3】 合成樹脂層が単層のポリオレフィン系樹脂層からなり、該ポリオレフィン系樹脂発泡シートの密度： d (g/L) と、該単層のポリオレフィン系樹脂層を構成しているポリオレフィン系樹脂のメルトフローレ

イト： X ($g/10分$) と、該単層のポリオレフィン系樹脂層の坪量： Y (g/m^2) とが、下記(1)～(4)式の関係を満足することを特徴とする請求項1または2記載のポリオレフィン系樹脂積層発泡体。

$$\text{【数1】} \quad Y \leq 0.27dX \quad \cdots (1)$$

$$\text{【数2】} \quad 2 \leq X \leq 40 \quad \cdots (2)$$

$$\text{【数3】} \quad 5 \leq Y < 80 \quad \cdots (3)$$

$$\text{【数4】} \quad 100 \leq d \leq 450 \quad \cdots (4)$$

【請求項4】 合成樹脂層の坪量が $80 \sim 380$ (g/m^2) であり、且つ複数層のポリオレフィン系樹脂層からなり、該複数層のポリオレフィン系樹脂層の内、最外層を構成しているポリオレフィン系樹脂層の坪量が 5 (g/m^2) 以上、 80 (g/m^2) 未満であり、該ポリオレフィン系樹脂発泡シートの密度： d (g/L) と、該複数層のポリオレフィン系樹脂層のうち該最外層以外の樹脂層からなる内層を構成しているポリオレフィン系樹脂のメルトフローレイト： X' ($g/10分$) と、該内層の坪量： Y' (g/m^2) とが、下記(5)～(8)式の関係を満足することを特徴とする請求項1または2記載のポリオレフィン系樹脂積層発泡体。

$$\text{【数5】} \quad Y' \leq 0.27dX' \quad \cdots (5)$$

$$\text{【数6】} \quad 5 \leq X' \leq 40 \quad \cdots (6)$$

$$\text{【数7】} \quad 70 \leq Y' \leq 300 \quad \cdots (7)$$

$$\text{【数8】} \quad 100 \leq d \leq 450 \quad \cdots (8)$$

【請求項5】 ポリオレフィン系樹脂発泡シートを構成する基材樹脂がポリプロピレン系樹脂であることを特徴とする請求項1～4のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項6】 ポリオレフィン系樹脂層を構成する基材樹脂がポリプロピレン系樹脂であることを特徴とする請求項1～5のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項7】 帯電防止剤の結晶化温度が、ポリオレフィン系樹脂発泡シートを構成する基材樹脂の結晶化温度(T_c)を基準として、($T_c + 40^\circ C$) 以下であることを特徴とする請求項1～6のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項8】 帯電防止剤の主成分がポリエーテルエステルアミドであることを特徴とする請求項1～7のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項9】 帯電防止剤の主成分がポリエーテルであることを特徴とする請求項1～7のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項10】 帯電防止剤の主成分が、ポリエーテルとポリプロピレンとの共重合体、または、ポリエーテル

とポリプロピレンとの混合物であることを特徴とする請求項1～7のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項11】 帯電防止剤が $2 \sim 30$ 重量%含有されていることを特徴とする請求項1～10のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項12】 最外層を構成しているポリオレフィン系樹脂層が抗菌剤を含有していることを特徴とする請求項1～11のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項13】 積層発泡体全体の厚みが $0.5 \sim 10$ mmであり、積層発泡体の独立気泡率が 60% 以上であることを特徴とする請求項1～12のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項14】 積層発泡体が共押出し法により得られたものであることを特徴とする請求項1～13のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【請求項15】 帯電防止剤を含有するポリオレフィン系樹脂層を構成している、帯電防止剤のメルトフローレイト α ($g/10分$) とポリオレフィン系樹脂のメルトフローレイト β との比(α/β) が 0.5 以上であるこ

とを特徴とする請求項1～14のいずれかに記載のポリオレフィン系樹脂積層発泡体。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、各種容器の仕切り板や芯材、通い箱、収納箱、電気・電子部品搬送トレイなどに使用されるシート状又は板状ポリオレフィン系樹脂積層発泡体に関する。

【0002】

【従来の技術】従来、シート状のポリオレフィン系樹脂発泡体は、食品用トレイ、弁当箱、丼、カップ等の各種の容器や通い箱、収納箱などに広く使用されてきた。しかしながら、ポリオレフィン系樹脂発泡体は静電気が帯電しやすいので埃が付着しやすく汚れやすいという欠点があるので、モノグリセリンエステル系等の低分子量の界面活性剤を添加することにより、帯電防止効果を付与することが行われてきた。

【0003】しかしながら、モノグリセリンエステル系等の低分子量の界面活性剤は、成形品表面にブリードアウトしなければ帯電防止効果を発揮しない。従って、低分子量の界面活性剤は目的とする帯電防止効果が発現するまで通常一週間以上必要とするので、該界面活性剤が添加されたポリオレフィン系樹脂発泡体は、広い倉庫スペースを必要とし、納期のやりくりが困難であるという問題を抱えている。

【0004】又、前記界面活性剤は空気中の水分を取り込まなければ帯電防止効果を発現しないので、季節や使用される環境の影響を大きく受け、その結果目的とする帯電防止効果を発現しない場合があるという問題も有している。

【0005】更に、前記界面活性剤が添加された発泡体は水、洗剤などによって、洗浄を行なうと界面活性剤が洗い落とされるので、再び帯電防止効果を発揮するまでに時間を必要とする。従って、このような界面活性剤が

添加された発泡体を使用した通い箱等は、洗浄し再使用することが難しいので静電気や埃を嫌う用途においてリターナブルな使用は困難である。

【0006】

【発明が解決しようとする課題】本発明は、成形直後から十分な帯電防止効果を有し、洗浄によって帯電防止効果が損なわれることなく、リターナブルな用途に使用可能な積層ポリオレフィン系樹脂発泡体及び十分な強度を有する積層ポリオレフィン系樹脂発泡体の提供を目的とするものである。

【0007】

【課題を解決するための手段】すなわち本発明は、

(1) ポリオレフィン系樹脂発泡シートの少なくとも片面に合成樹脂層が積層されてなる積層発泡体において、該合成樹脂層が最外層にポリオレフィン系樹脂層を有する1層以上のものであり、該ポリオレフィン系樹脂層には表面固有抵抗が 1×10^{13} (Ω/\square) 以下となるようにポリマータイプの帯電防止剤が含有されていることを特徴とするポリオレフィン系樹脂積層発泡体、(2) ポリオレフィン系樹脂発泡シートの少なくとも片面に合成樹脂層が積層されてなる積層発泡体において、該合成樹脂層が最外層にポリオレフィン系樹脂層を有する1層以上のものであり、該ポリオレフィン系樹脂層には、エタノールによる超音波洗浄後の表面固有抵抗が $1 \times 10^8 \sim 1 \times 10^{13}$ (Ω/\square) となるように帯電防止剤が含有されていることを特徴とするポリオレフィン系樹脂積層発泡体、(3) 合成樹脂層が単層のポリオレフィン系樹脂層からなり、該ポリオレフィン系樹脂発泡シートの密度： d (g/L) と、該単層のポリオレフィン系樹脂層を構成しているポリオレフィン系樹脂のメルトフローレイト： X (g/10分) と、該単層のポリオレフィン系樹脂層の坪量： Y (g/m²) とが、下記(1)～(4)式の関係を満足することを特徴とする前記(1)または(2)記載のポリオレフィン系樹脂積層発泡体、

$$\text{【数9】} \quad Y \leq 0.27 d X \quad \cdots (1)$$

$$\text{【数10】} \quad 2 \leq X \leq 40 \quad \cdots (2)$$

$$\text{【数11】} \quad 5 \leq Y < 80 \quad \cdots (3)$$

$$\text{【数12】} \quad 100 \leq d \leq 450 \quad \cdots (4)$$

(4) 合成樹脂層の坪量が80～380 (g/m²) であり、且つ複数層のポリオレフィン系樹脂層からなり、該複数層のポリオレフィン系樹脂層の内、最外層を構成しているポリオレフィン系樹脂層の坪量が5 (g/m²) 以上、80 (g/m²) 未満であり、該ポリオレフィン系樹脂発泡シートの密度： d (g/L) と、該複

数層のポリオレフィン系樹脂層のうち該最外層以外の樹脂層からなる内層を構成しているポリオレフィン系樹脂のメルトフローレイト： X' (g/10分) と、該内層の坪量： Y' (g/m²) とが、下記(5)～(8)式の関係を満足することを特徴とする前記(1)または(2)記載のポリオレフィン系樹脂積層発泡体、

$$\text{【数13】} \quad Y' \leq 0.27 d X' \quad \cdots (5)$$

【数14】 $5 \leq X' \leq 40$ (6)

【数15】 $70 \leq Y' \leq 300$ (7)

【数16】 $100 \leq d \leq 450$ (8)

(5) ポリオレフィン系樹脂発泡シートを構成する基材樹脂がポリプロピレン系樹脂であることを特徴とする前記(1)～(4)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(6) ポリオレフィン系樹脂層を構成する基材樹脂がポリプロピレン系樹脂であることを特徴とする前記(1)～(5)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(7) 帯電防止剤の結晶化温度が、ポリオレフィン系樹脂発泡シートを構成する基材樹脂の結晶化温度(T_c)を基準として、($T_c + 40^\circ\text{C}$)以下であることを特徴とする前記(1)～(6)のいずれかに記載のポリオレフィン系樹脂積層発泡体、

(8) 帯電防止剤の主成分がポリエーテルエステルアミドであることを特徴とする前記(1)～(7)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(9) 帯電防止剤の主成分がポリエーテルであることを特徴とする前記(1)～(7)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(10) 帯電防止剤の主成分が、ポリエーテルとポリプロピレンとの共重合体、または、ポリエーテルとポリプロピレンとの混合物であることを特徴とする前記(1)～(7)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(11) 帯電防止剤が2～30重量%含有されていることを特徴とする前記(1)～(10)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(12) 最外層を構成しているポリオレフィン系樹脂層が抗菌剤を含有していることを特徴とする前記(1)～(11)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(13) 積層発泡体全体の厚みが0.5～10mmであり、積層発泡体の独立気泡率が60%以上であることを特徴とする前記(1)～(12)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(14) 積層発泡体が共押出し法により得られたものであることを特徴とする前記(1)～(13)のいずれかに記載のポリオレフィン系樹脂積層発泡体、(15) 帯電防止剤を含有するポリオレフィン系樹脂層を構成している、帯電防止剤のメルトフローレイト α (g/10分)とポリオレフィン系樹脂のメルトフローレイト β との比(α/β)が0.5以上であることを特徴とする前記(1)～(14)のいずれかに記載のポリオレフィン系樹脂積層発泡体、を要旨とする。

【0008】

【発明の実施の形態】本発明のポリオレフィン系樹脂積層発泡体(以下、単に積層発泡体という。)は、ポリオレフィン系樹脂発泡シート(以下、単に発泡シートという。)の片面または両面に、単層または複数層の合成樹

脂層が積層されたものである。そして該合成樹脂層の密度は300(g/L)以上、即ち低発泡のものであったり、フィラーを多量に含有しているもの等であってもよい。更に該合成樹脂層の最外層としてポリオレフィン系樹脂層を有している。即ち、本発明の積層発泡体は、片面または両面の最外層にポリオレフィン系樹脂層(以下、単に最外樹脂層という。)を有するものである。

【0009】従って、本発明の積層発泡体は、最も簡単な層構成として、発泡シートの片面に最外樹脂層が積層されたものが挙げられ、その他、発泡シートの両面に最外樹脂層が積層されたもの、発泡シートの両面の各々に最外樹脂層と他の樹脂層の2層以上からなる合成樹脂層が積層されたもの等が挙げられる。尚、本明細書において合成樹脂層が複数層のポリオレフィン系樹脂層からなる場合、最外樹脂層以外の樹脂層、即ち内層は、1層または2層以上のポリオレフィン系樹脂層から構成される。本発明の積層発泡体は、このような構造を有するもので、特に、発泡シートの種類、密度と、最外樹脂層の種類、坪量、最外樹脂層以外の合成樹脂層の種類、坪量、メルトフローレイトとの組合せを適宜定めることにより、積層発泡体の用途に応じた幅広い物性を有する積層体となりうるものである。

【0010】本発明の積層発泡体は全体の厚みが0.5～10mmであることが好ましく、1～8mmであることがより好ましい。全体の厚みが0.5mm未満の場合は、用途によっては、例えば積層発泡体を加工して得られた箱、容器等の壁厚が不十分となり、強度、断熱性、緩衝性などが低下する虞がある。一方、全体の厚みが8mmを超えると、ヒンジ等の曲げ加工性、箱、容器等への成形加工性が低下する虞がある。

【0011】本明細書における積層発泡体の厚みは、発泡シートの押出方向に対して垂直な幅方向の断面の厚みを顕微鏡により等間隔に10点撮影を行い、ついで撮影した写真より積層発泡体の厚みを測定し、各測定値の算術平均値を積層発泡体の厚みとする。

【0012】本発明の積層発泡体を構成する発泡シートは、押出发泡法により製造することができ、合成樹脂層も押出加工により製造することができる。本発明において、発泡シートに合成樹脂層を積層する方法としては、別途製造した発泡シートに合成樹脂層を押出ラミする方法、発泡シートに別工程で製造したフィルム(合成樹脂層)を熱ラミする方法、異なる押出機を用いて形成した発泡シートと合成樹脂層をダイ内で積層してから押出す共押出し法等が挙げられる。

【0013】これらの方法の中では、ポリマータイプの帯電防止剤や抗菌剤等の高価な添加剤を最外樹脂層に混合する場合に安価な積層発泡体を得ることができるという観点からは、より薄い最外樹脂層を形成することが容易な共押し法が好ましい。また、本発明において使用されるポリマータイプの帯電防止剤はポリオレフィン系樹脂層表面に筋状に分散して連続層を形成した状態で配置することにより、ポリマータイプの帯電防止剤の本来の帯電防止効果を発現させることができる。そして、共押し法に比べて、帯電防止剤の熔融混練時または帯電防止剤含有樹脂層の発泡シートへの積層時において熔融樹脂の温度上の制約が小さく、また適度に配向された帯電防止剤含有樹脂層を形成し易いという理由から、比較的容易に筋状に分散した帯電防止剤の連続層を形成できる、押出ラミ法や別工程で製造したフィルムを熱ラミする方法も採用できる。

【0014】本発明における発泡シートの押出発泡法による製造について詳述する。該発泡シートは、基材樹脂を押出機内で熔融させると共に発泡剤と混練した後、この熔融混練物を押出機先端に取り付けたダイを通して低圧下に押出して発泡することにより得ることができる。シート状の発泡体として形成するためには、環状のリップを有するサーキュラーダイを用い、このダイのリップより押出発泡してチューブ状の発泡体を得、次いで、このチューブを切り開いてシート状とする方法が好ましく採用される。尚、サーキュラーダイに代えてTダイ等のフラットダイから押出す方法によって製造することも可能である。

【0015】本発明の発泡シートを構成する基材樹脂はポリオレフィン系樹脂であり、該ポリオレフィン系樹脂としては、ポリプロピレン系樹脂、ポリエチレン系樹脂等が挙げられる。ポリオレフィン系樹脂は、柔軟性に富み、引張り強度等の物理的強度に優れ、耐薬品性を有し、押出発泡性適正があるので、本発明の発泡シートを構成する基材樹脂として優れた素材であり、本発明においては、ポリオレフィン系樹脂の中でも特に剛性や耐熱性に優れるポリプロピレン系樹脂が好ましく使用される。

【0016】上記ポリプロピレン系樹脂としては、プロピレン単独重合体、またはプロピレンと共重合可能な他のオレフィンとの共重合体が挙げられる。プロピレンと共重合可能な他の共重合成分としては、例えば、エチレン、1-ブテン、イソブチレン、1-ペンテン、3-メチル-1-ブテン、1-ヘキセン、3, 4-ジメチル-1-ブテン、1-ヘプテン、3-メチル-1-ヘキセンなどの、エチレンまたは炭素数4~10の α -オレフィンが例示される。また上記共重合体は、ランダム共重合体であってもブロック共重合体であってもよく、さらにまた二元共重合体のみならず三元共重合体であってもよ

い。また、これらのポリプロピレン系樹脂は、単独または2種以上を混合して用いることができる。

【0017】上記の共重合体を、発泡シートを構成する基材樹脂として使用する場合、共重合体中に共重合成分が25重量%以下、特に15重量%以下の割合で含有されていることが好ましい。また共重合体中に含有する共重合成分の好ましい下限値は0.3重量%である。

【0018】上記のポリプロピレン系樹脂の中でも押出発泡に好適な樹脂としては、一般のポリプロピレン系樹脂と比較して熔融張力が高いポリプロピレン系樹脂を含有するものが好ましく、特に、該熔融張力が高いポリプロピレン系樹脂を15~50重量%含有するポリプロピレン系樹脂が、本発明積層発泡体の製造コスト、リサイクル性および押出発泡適正を兼備することから好ましい。尚、該熔融張力が高いポリプロピレン系樹脂とは、例えば、特許登録2521388号、特開平7-53797号公報に記載されているような、(1)1未満の枝分かれ指数と著しい歪み硬化伸び粘度とを有するポリプロピレンや、(2)(a)Z平均分子量(M_z)が 1.0×10^6 以上であるか、またはZ平均分子量(M_z)と重量平均分子量(M_w)との比(M_z/M_w)が3.0以上であり、(b)かつ平衡コンプライアンス J_0 が $1.2 \times 10^{-3} \text{ m}^2/\text{N}$ 以上であるか、または単位応力当たりの剪断歪み回復 S_r/S が毎秒 $5 \text{ m}^2/\text{N}$ 以上であるもの、(3)スチレン等のラジカル重合性単量体およびラジカル重合開始剤や添加剤などを含む配合物を、ポリプロピレン系樹脂が熔融し、かつラジカル重合開始剤の反応温度以上において熔融混練することによって改質されたポリプロピレン系樹脂、あるいは(4)ポリプロピレン系樹脂とイソブレン単量体とラジカル重合開始剤とを熔融混練して得られる改質ポリプロピレン系樹脂が挙げられる。

【0019】また、上記の熔融張力が高いポリプロピレン系樹脂中でも沸騰キシレンに対する不溶解成分の割合が低いものが好ましい。

【0020】上記不溶解成分の割合は、重量を精秤したポリプロピレン系樹脂またはその発泡シートを試料とし、約145℃のキシレン中に試料を入れ8時間加熱還流した後、100メッシュの金網で速やかに濾過し、ついて金網上に残った沸騰キシレン不溶解成分を20℃のオーブン中で24時間乾燥したのち、不溶解成分の重量 $G(g)$ を測定し、下記式(9)により求められる。不溶解成分の割合が0~10重量%であることが好ましく、より好ましくは、0~5重量%、更に好ましくは0~2重量%である。不溶解成分の割合が低い樹脂程リサイクル性に優れておりコスト低減に繋がる点で好ましいものである。

【0021】

【数17】

乾燥後の不溶解成分の割合(重量%)

$$= [G(g) / \text{試料重量}(g)] \times 100 \dots (9)$$

【0022】本発明においては、上記発泡シートの基材樹脂をポリプロピレン系樹脂で構成する場合、ポリプロピレン系樹脂に、さらに必要に応じて他の樹脂を混合したものを使用することができる。他の樹脂としては、例えば、アイオノマー；エチレン-プロピレンゴム、スチレン-ブタジエンゴム等のゴム；スチレン-ブチレン-スチレンブロック共重合体、スチレン-イソプレン-スチレンブロック共重合体、スチレン-ブチレン-スチレンブロック共重合体水添物、スチレン-イソプレン-スチレンブロック共重合体水添物、エチレン-オクテンブロック共重合、エチレン-ブチレンブロック共重合等の熱可塑性エラストマー；高密度ポリエチレン、低密度ポリエチレン、直鎖状低密度ポリエチレン、直鎖状超低密度ポリエチレン、エチレン-ブテン共重合体、エチレン-無水マレイン酸共重合体等のエチレン系樹脂；ブテン系樹脂；ポリ塩化ビニル、塩化ビニル-酢酸ビニル共重合体等の塩化ビニル系樹脂；スチレン系樹脂等が挙げられる。これらの他の樹脂を混合する場合には、その混合量は、基材樹脂総重量の40重量%以下にすることが好ましい。

【0023】また、本発明における発泡シートの基材樹脂をポリエチレン系樹脂で構成する場合、該ポリエチレン系樹脂としては、エチレンの単独重合体またはエチレンと炭素数が3～12個の α -オレフィンとからなる共重合体が基材樹脂中に60重量%以上含有されているものが挙げられ、具体的には、高密度ポリエチレン、中密度ポリエチレン、低密度ポリエチレン、直鎖状低密度ポリエチレン、直鎖状超低密度ポリエチレン、エチレン-酢酸ビニル共重合体から選択される1種または2種以上の混合物、更には40重量%以下の割合でプロピレン系樹脂、ポリスチレン系樹脂等のその他の樹脂を混合したものが挙げられる。

【0024】本発明における発泡シートを製造するための発泡剤としては、無機系物理発泡剤、有機系物理発泡剤、分解型発泡剤等が用いられる。無機系物理発泡剤としては、二酸化炭素、空気、窒素等を用いることができる。有機系物理発泡剤としてはプロパン、*n*-ブタン、

$$S(\%) = (V_x - W/\rho) \times 100 / (V_a - W/\rho) \dots (10)$$

【0029】但し、上記(10)式において、 V_x は上記した方法で測定される真の体積(cm^3)で、測定に使用した積層発泡体を構成する樹脂の容積と、測定に使用した積層発泡体内の独立気泡部分の気泡全容積との和に相当する。その他、上記(10)式中の、 V_a 、 W 、 ρ は以下の通りである。

【0030】 V_a ：測定に使用した積層発泡体の外形寸法から計算される積層発泡体の見掛けの体積(cm^3)
 W ：測定に使用した積層発泡体の全重量(g)
 ρ ：積層発泡体を構成する樹脂の密度(g/cm^3)
 尚、積層発泡体を構成する樹脂の密度 ρ は、ヒートプレ

i-ブタン、ペンタン、ヘキサン等の脂肪族炭化水素、シクロブタン、シクロペンタン等の環式脂肪族炭化水素、1, 1, 1, 1-テトラフルオロエタン、1, 1-ジフルオロエタン、メチルクロライド、エチルクロライド、メチレンクロライド等のハロゲン化炭化水素、ジメチルエーテル、メチルエチルエーテル等のエーテル等を用いることができる。また分解型発泡剤としては、アゾジカルボンアミド、ジニトロソペンタメチレンテトラミン、アゾビスイソブチロニトリル、重炭酸ナトリウム等を用いることができる。これらの発泡剤は適宜混合して用いることもできる。尚、本発明においては、特に物理発泡剤を使用することが、低い坪量の発泡シートを得る上で好ましい。

【0025】又、本発明における発泡シートは、必要に応じて各種添加剤を添加することができる。添加剤としては、タルク、シリカ等の無機粉末や多価カルボン酸の酸性塩、多価カルボン酸と炭酸ナトリウム或いは重炭酸ナトリウムとの反応混合物等の気泡調整剤、タルク、シリカ、炭酸カルシウム、クレー、ゼオライト、アルミナ、硫酸バリウム等の無機充填剤（タルク、シリカは気泡調整剤としての機能も有する。）、熱安定剤、紫外線吸収剤、酸化防止剤、着色剤等が挙げられる。また、帯電防止剤や抗菌剤を配合してもよい。

【0026】本発明における積層発泡体の独立気泡率は、60%以上、更に、70%以上であることが好ましく、80%以上であることが特に好ましい。独立気泡率が60%より低くなると、発泡シートの剛性や圧縮強度が低下し、例えば積層発泡体を加工して得られる箱、容器等の物理的強度が低下する虞がある。

【0027】本明細書における積層発泡体の独立気泡率： $S(\%)$ は、ASTM D2856-70に記載されている手順Cに準拠し、東芝ベックマン株式会社製の空気比較式比重計930型を使用して測定される積層発泡体の真の体積： V_x から、下記(10)式により算出される。

【0028】

【数18】

スにより該積層発泡体から気泡を脱泡させる操作を行い、得られたサンプルから密度を求めることができる。

【0031】尚、試験片は、空気比較式比重計に付属のサンプルカップに非圧縮状態で収納しなければならないので、縦と横がそれぞれ2.5cm、高さが4cmになるようにカットし、見掛け体積が25 cm^3 のものとする。但し、積層発泡体の厚みが4cmに満たない場合は25 cm^3 に最も近づくように該積層発泡体からカットした測定用試験片を複数枚組み合わせる試験片として使用する。

【0032】本発明における最外樹脂層以外の合成樹脂

層を構成する基材樹脂としては、発泡シートと同様のポリプロピレン系樹脂やポリエチレン系樹脂、その他、ガスバリアー性等の機能性を有するエチレン酢酸ビニル共重合体のケン化物、塩化ビニリデン樹脂、ポリアミド樹脂等が挙げられ、中でも発泡シートやポリオレフィン系樹脂層と良好に接着するという点で、該合成樹脂層と最外樹脂層と発泡シートとを構成する樹脂は十分な熱接着性を示す同種類のものを用いることが好ましく、安価な積層発泡体を得るためには、該合成樹脂層は発泡シートの基材樹脂と同種類のリサイクル原料を配合したものを用いることがより好ましい。

【0033】又、合成樹脂層の一部または全てを構成する最外樹脂層を構成する基材樹脂としては、発泡シートと同様のポリプロピレン系樹脂やポリエチレン系樹脂が挙げられ発泡シート或いは他の合成樹脂層と良好に接着するという点で、それらを構成する樹脂は十分な熱接着性を示す同種類のものを用いることが好ましく、安価な積層発泡体を得るためには、最外樹脂層は発泡シートの基材樹脂と同種類のリサイクル原料を配合したものを用いることがより好ましい。

【0034】又、最外樹脂層を含む合成樹脂層を構成する基材樹脂には抗菌剤、エラストマーなどの添加剤を一種以上添加することが、本発明の積層発泡体をより機能的なものとすることができる。

【0035】上記抗菌剤としては、銀、銅、亜鉛等の抗菌活性をもつ金属（イオン）を担体に担持したもの、例えば銀ゼオライト、銅ゼオライト、銀担持リン酸ジルコニウム、銀担持シリカゲルなどの無機系薬剤、アナターゼ型酸化チタンに代表される酸化物系光触媒を利用した抗菌剤、塩化ベンザルコニウム、塩化ポリオキシエチレントリアルキルアンモニウム、ポリヘキサメチレンピグアニド塩酸塩、塩化3-（トリメトキシシリル）プロピルジメチルオクタデシルアンモニウム等の有機系薬剤などが挙げられる。

【0036】本発明における最外樹脂層を含む合成樹脂層の密度は好ましくは300（g/L）以上で、更に好ましくは基材樹脂の密度、即ち非発泡樹脂からなるものである。合成樹脂層の密度が300（g/L）以上の場合は、合成樹脂層を積層することによる、物性向上効果、機能付加効果、外観向上効果などを発揮することができる。

【0037】本明細書において、合成樹脂層や、合成樹脂層中の最外樹脂層の密度の測定は、積層発泡体から密度を測定する目的の樹脂層を切り出して、切り出したサンプルの重量（g）を切り出したサンプルの外形状法から求められる体積（L）にて割り算することにより求められる。

【0038】本発明の積層発泡体は、最外樹脂層がポリマータイプの帯電防止剤（所謂、永久帯電防止剤。）を含有しており、該ポリマータイプの帯電防止剤は最外樹

脂層の表面固有抵抗が 1×10^{13} （ Ω/\square ）以下、好ましくは 1×10^{12} （ Ω/\square ）以下、更に好ましくは 1×10^{11} （ Ω/\square ）以下となるように最外樹脂層を構成するポリオレフィン系樹脂に含有されている。尚、表面固有抵抗の下限は、特に限定されないが、おおむね 1×10^8 （ Ω/\square ）である。

【0039】ポリマータイプの帯電防止剤は単純にポリオレフィン系樹脂に配合すれば帯電防止効果を発揮するというものではなく、帯電防止剤がポリオレフィン系樹脂層表面に筋状に分散して連続層を形成した状態（以下、ネットワーク構造という。）で樹脂層表面に配置されていなければ帯電防止効果を発揮しないと考えられる。

【0040】かかるネットワーク構造は、最外樹脂層を形成する際に適度な配向をかけることにより形成され易い。従って、ネットワーク構造を形成するという観点からは、最外樹脂層は押出ラミ法や熱ラミ法により形成することが好ましい。

【0041】一方、ポリマータイプの帯電防止剤は極めて高価で、低価格の製品を製造するためには使用量が制限される。従って、ポリマータイプの帯電防止剤は積層発泡体の最外樹脂層のみに配合するだけで十分であり、該最外樹脂層はできる限り薄くして樹脂量を減らし坪量 5 g/m^2 以上 80 g/m^2 未満で形成することが好ましい。

【0042】このようにできる限り薄くして樹脂量を減らした最外樹脂層を形成するという観点からは、共押し法を採用することが好ましい。

【0043】表面固有抵抗が 1×10^{13} （ Ω/\square ）を超える場合は、帯電防止効果が不十分となり、積層発泡体の表面には静電荷が蓄積し、埃が付着する。

【0044】本明細書における表面固有抵抗の測定は、基本的にJIS K6911（1995）に準拠して行なうものとする。具体的には、得られた積層発泡体から、試験片（縦100mm×横100mm×厚み：試験片厚み）を発泡シートの押し出し方向に対して垂直な幅方向に等間隔で3片切り出し、試験片を23℃、湿度50%の雰囲気下に24時間放置した後、表面抵抗率を測定し、得られた測定値の平均値を表面固有抵抗とする。尚、上記測定方法は、JIS K6911（1995）に準拠するものであり、試験片の状態調整は23℃、湿度50%の雰囲気下に24時間放置することにより行うこととなっているためその条件を本明細書において採用したが、本発明においてはポリマータイプの帯電防止剤が配合されたものであるため、放置時間や湿度の条件によらず積層発泡体製造直後から安定した表面固有抵抗を示すものである。よって、本発明の積層発泡体は上記条件にて24時間放置してもしなくても略同様の表面固有抵抗を示す積層発泡体となる優れた効果を発揮する。

【0045】本明細書において、最外樹脂層の表面固有

抵抗が 1×10^{13} (Ω/\square) 以下となるようにとは、構造的には最外樹脂層を構成する基材樹脂中にポリマータイプの帯電防止剤がネットワーク構造のような十分に帯電防止性能を発揮する構造を形成し、該構造を通じて静電気が伝導できることを意味する。このような構造が形成されていない場合は、ポリマータイプの帯電防止剤が配合されていても、表面固有抵抗が 1×10^{13} (Ω/\square) 以下の最外樹脂層を得ることは難しい。

【0046】本明細書において、ポリマータイプの帯電防止剤とは、少なくとも数平均分子量が300以上、好ましくは300~300000、更に好ましくは600~15000で、かつ表面固有抵抗が $1 \times 10^{12} \Omega$ よりも小さい樹脂のことを示す。また本明細書におけるポリマータイプの帯電防止剤は無機塩又は低分子量有機プロトン酸塩、例えば LiClO_4 、 LiCF_3SO_3 、 NaClO_4 、 LiBF_4 、 NaBF_4 、 KBF_4 、 KClO_4 、 KPF_3SO_3 、 $\text{Ca}(\text{ClO}_4)_2$ 、 $\text{Mg}(\text{ClO}_4)_2$ 、 $\text{Zn}(\text{ClO}_4)_2$ 等を含含有していても良い。尚、ポリマータイプの帯電防止剤の数平均分子量の上限は50000程度である。

【0047】上記分子量はゲルパーミエーションクロマトグラフィーを用い、分子量既知のポリスチレンから得られる校正曲線を使用して換算された数平均分子量（ポリスチレン換算値）である。

【0048】本明細書において、ポリマータイプの帯電防止剤は具体的には、ポリエチレンオキシド、ポリプロピレンオキシド、ポリエチレングリコール、ポリエーテル、ポリエステルアミド、ポリエーテルエステルアミド、エチレン-メタクリル酸共重合体などのアイオノマー、ポリエチレングリコールメタクリレート系重合体等の第四級アンモニウム塩から選択される1種、または2種以上の混合物、または2種以上の共重合体、更にそれらとポリプロピレンなどの他の樹脂との共重合体等の中で、分子鎖中に極性基を有し無機塩又は低分子量有機プロトン酸塩を錯体形成または溶媒和することが可能な樹脂が挙げられ、無機塩又は有機プロトン酸塩等を錯体形成または溶媒和せしめてあってもよい。尚、ポリマータイプの帯電防止剤の融点の上限はおおむね270℃であり、下限はおおむね70℃であり、好ましくは80~230℃、更に好ましくは80~200℃である。帯電防止剤の融点が上記範囲内のものを選択することにより、帯電防止剤が添加される基材樹脂の基礎物性を維持しつつ、良好な前記ネットワーク構造を形成することが比較的容易に可能となる。また、ポリマータイプの帯電防止剤の結晶化温度は、ポリオレフィン系樹脂発泡シートを構成する基材樹脂の結晶化温度(T_c)を基準として、($T_c + 40^\circ\text{C}$) 以下であることが好ましい。尚、該帯電防止剤の結晶化温度の下限はおおむね60℃である。帯電防止剤の結晶化温度が上記範囲内のものを選択することにより、帯電防止効果において優れたものが得られ、また、特に共押出し法により本発明の積層発泡体を得る場合に外観において特に優れたものがえられる。

得る場合に外観において特に優れたものがえられる。

【0049】本明細書において、帯電防止剤または樹脂層等を構成する樹脂の融点及び結晶化温度の測定方法はJIS K7121-1987に準拠して、熱流束示差走査熱量測定により求められる値である。測定条件の詳細については以下の通りとする。

融点：JIS K7121-1987、3. 試験片の状態調節(2)の条件(但し、冷却速度10℃/分。)により試験片を状態調整した試験片を使用して、10℃/分にて昇温することにより融解ピークを得る。得られた融解ピークの頂点の温度を融点とする。尚、融解ピークが2つ以上現れる場合は、最も面積の大きな融解ピークの頂点の温度を融点とする。但し、最も面積の大きな融解ピークが複数存在する場合は、それらの融解ピークの頂点の温度の算術平均値を融点とする。

結晶化温度：JIS K7121-1987、3. 試験片の状態調節(2)の条件において、冷却速度10℃/分の降温時に得られる発熱ピークの頂点の温度を結晶化温度とする。尚、発熱ピークが2つ以上現れる場合は、最も面積の大きな発熱ピークの頂点の温度を結晶化温度とする。但し、最も面積の大きな発熱ピークが複数存在する場合は、それらの発熱ピークの頂点の温度の算術平均値を結晶化温度とする。

【0050】本発明において用いるポリマータイプの帯電防止剤の中でも特にポリエーテルエステルアミド、ポリエーテルを主成分とするものが好ましい。これらの帯電防止剤は、最外樹脂層の基材樹脂のメルトフローレイトと帯電防止剤のメルトフローレイトとの比に大きく左右されずに優れた帯電防止効果を発揮させることができる。更に、これらの帯電防止剤には最外樹脂層の基材樹脂との相溶性を向上させ、優れた帯電防止効果及び帯電防止剤を添加することによる物性低下を抑制する効果を得るために同種のポリオレフィン系樹脂やポリアミドをポリマータイプの帯電防止剤に混合または共重合させたものを用いることが好ましい。尚、本明細書において主成分とするとは50重量%以上、好ましくは75重量%以上、更に好ましくは85重量%以上の割合で含有されていることを意味する。これらの帯電防止剤を用いて、後述する方法でネットワーク構造等を形成することにより、表面固有抵抗が 1×10^{13} (Ω/\square) 以下の最外樹脂層を容易に形成することができる。

【0051】本明細書におけるポリエーテルエステルアミドは、下記に例示するポリアミド(1)とビスフェノール類のアルキレンオキシサイド付加物(2)との重合反応により得られるものである。

【0052】ポリアミド(1)は、(a)ラクタム開環重合体、(b)アミノカルボン酸の重縮合体、若しくは(c)ジカルボン酸とジアミンの重縮合体である。(a)のラクタムとしてはカプロラクタム、エナントラクタム、ラウロラクタム、ウンデカラクタム等が挙げられる。

【0053】前記(b)のアミノカルボン酸としては、 ω -アミノカプロン酸、 ω -アミノエナント酸、 ω -アミノカプリル酸、 ω -アミノベルゴン酸、 ω -アミノカプリン酸、11-アミノウンデカン酸、12-アミノドデカン酸等が挙げられる。

【0054】前記(c)のジカルボン酸としては、アジピン酸、アゼライン酸、セバシン酸、ウンデカンジ酸、ドデカンジ酸、イソフタル酸等が挙げられ、またジアミンとしてはヘキサメチレンジアミン、ヘプタメチレンジアミン、オクタメチレンジアミン、デカメチレンジアミン等が挙げられる。

【0055】上記アミド形成性モノマーとして例示したものは二種類以上使用しても良い。これらのうち好ましいものはカプロラクタム、12-アミノドデカン酸、及びアジピン酸-ヘキサメチレンジアミンであり、特に好ましいものはカプロラクタムである。

【0056】前記ビスフェノール類のアルキレンオキシド付加物(2)のビスフェノール類としては、ビスフェノールA(4,4'-ジヒドロキシジフェニル-2,2-プロパン)、ビスフェノールF(4,4'-ジヒドロキシジフェニルメタン)、ビスフェノールS(4,4'-ジヒドロキシジフェニルスルホン)、4,4'-ジヒドロキシジフェニル-2,2-ブタン等が挙げられ、これらのうち特に好ましいものはビスフェノールAである。

【0057】また前記ビスフェノール類のアルキレンオキシド付加物(2)のアルキレンオキシドとしては、エチレンオキシド、プロピレンオキシド、1,2-若しくは1,4-ブチレンオキシド、及びこれらの二種類以上の混合物が挙げられる。これらのうち好ましいものはエチレンオキシドである。

【0058】本発明において最外樹脂層が含有するポリエーテルエステルアミドの融点は、230℃以下であることが好ましく、200℃以下であることがより好ましい。該融点が230℃を超えると、ポリオレフィン系樹脂とポリエーテルエステルアミドとを熔融し混合する際、両樹脂の温度を必要以上に高くしなければならないので、ポリオレフィン系樹脂が劣化する虞がある。又、共押出し法により積層する場合は、樹脂層の積層量にもよるが発泡シートが連続気泡構造になり剛性が低下する虞がある。

【0059】ポリエーテルエステルアミドの融点が200℃以下の場合は、最外樹脂層を構成するポリオレフィン系樹脂が劣化する虞が殆どなく、共押出し法により積層する場合であっても、発泡シートが連続気泡構造になり剛性が低下する虞が殆どない。

【0060】本明細書におけるポリエーテルとしては、a)フェノール類・ジビニルベンゼン付加重合体にアルキレンオキシドを付加反応させることにより得られるオキシアルキレンエーテル、b)ポリオキシエチレングリコール、ポリオキシプロピレングリコール、ポリオキ

シブチレングリコール、ビスフェノール類のアルキレンオキシド付加物等のジグリシジルエーテルと、ヘキシル、 n -オクチル、2-エチルヘキシル、ノニル、デシル、ドデシル、テトラデシル、オクタデシル、オレイルなどの炭素数1~22(好ましくは炭素数6~22)の脂肪族炭化水素基を有するアミン化合物と、ジメチル硫酸、ジエチル硫酸等のアルキル硫酸エステル；ジメチル炭酸、ジエチル炭酸等のアルキル炭酸エステル；トリメチルホスフェイト、アルキルベンジルクロライド、ベンジルクロライド、アルキルクロライド、アルキルプロマイド等の各種ホスフェイトまたはハライドなどの4級化剤との反応物であり、かつ分子内に2個以上の4級アンモニウム塩基を有する化合物からなるカチオン型帯電防止剤等が挙げられる。

【0061】上記アルキレンオキシドとしては、エチレンオキシド、プロピレンオキシドおよびブチレンオキシドが挙げられ、これらの内、エチレンオキシド及びエチレンオキシドとプロピレンオキシドとの共重合体が好ましい。アルキレンオキシドの付加モル数は、通常1~500、好ましくは20~300であり、オキシアルキレンエーテル中のオキシアルキレン含量は、10~95重量%、好ましくは20~90重量%、より好ましくは30~80重量%である。

【0062】上記ビスフェノール類としては、ビスフェノールA(4,4'-ジヒドロキシジフェニル-2,2-プロパン)、ビスフェノールF(4,4'-ジヒドロキシジフェニルメタン)、ビスフェノールS(4,4'-ジヒドロキシジフェニルスルホン)、4,4'-ジヒドロキシジフェニル-2,2-ブタンなどのアルキレンオキシド付加物が挙げられる。

【0063】上記ジグリシジルエーテルのうち特に好ましいものは、ポリオキシエチレングリコールのグリシジルエーテル、ビスフェノール類のエチレンオキシド付加物のジグリシジルエーテルおよびこれらの混合物である。

【0064】上記アミン化合物のうち特に好ましいものは、 N -アルキル(炭素数1~18)ジエタノールアミンである。

【0065】上記4級化剤のうち特に好ましいものは、ジメチル硫酸およびジエチル硫酸である。

【0066】前述したポリエーテルエステルアミドまたはポリエーテルには、優れた帯電防止効果及び帯電防止剤を添加することによる物性低下を抑制する効果を得るためにポリアミドや、最外樹脂層を構成しているポリオレフィン系樹脂と同種類のポリオレフィン系樹脂(特に、数平均分子量が800~25000の変性ポリオレフィン系樹脂)が混合されているか共重合されていることがより好ましい。ここで使用されるポリアミドとしては、ジアミン及びジカルボン酸及び/又はアミノカルボン酸又は相当するラクタムから誘導されたポリアミド及

びコポリアミドが挙げられる。具体的には、ポリアミド4、ポリアミド6、ポリアミド6/6、6/10、6/9、6/12、4/6、12/12、ポリアミド11、ポリアミド12、*m*-キシレンジアミンとアジピン酸との芳香族ポリアミド、ヘキサメチレンジアミンとイソフタル酸及び/又はテレフタル酸とから、必要に応じてエラストマーを添加して得られるポリアミド、上記ポリアミドとポリオレフィン、オレフィンコポリマー、アイオノマー又はエラストマーとの共重合体、ポリアミドとポリエチレングリコール、ポリプロピレングリコール又はポリテトラメチレングリコールとのブロックコポリマー、EPDM又はABSで変性させたポリアミド又はコポリアミド等が例示される。これらのポリオレフィン系樹脂やポリアミドの含有量は50重量%以下、好ましくは25重量%以下、更に好ましくは25重量%以下である。上述したポリマータイプの帯電防止剤を添加したものは、上記エタノールによる超音波洗浄前後において、帯電防止効果は失われない。一方、モノグリセリンエステル系等の界面活性剤からなる帯電防止剤の場合は、成形品表面にブリードアウトし空気中の水分を取り込み帯電防止効果を発揮していても上記エタノールによる超音波洗浄後には帯電防止効果は失われてしまう。よって、添加されている帯電防止剤がポリマータイプの帯電防止剤か界面活性剤からなる帯電防止剤かを判別する手段として、上記エタノールによる超音波洗浄が有効である。

【0067】また、本発明の積層発泡体は帯電防止剤を最外樹脂層に含有することによりエタノールによる超音波洗浄前後において表面固有抵抗が $1 \times 10^8 \sim 1 \times 10^{13}$ (Ω/\square) の範囲内の値で殆ど変化しない作用を有するものである。そのような積層発泡体は帯電防止剤として前記ポリマータイプの帯電防止剤を含有させることにより得ることができる。尚、本明細書において、エタノールによる超音波洗浄とは、23℃のエタノール中に積層発泡体から切り出した試験片を沈めて超音波洗浄後、該試験片を温度30℃、相対湿度30%の雰囲気下

で36時間放置することにより乾燥させる操作を指し、エタノールによる超音波洗浄後の表面固有抵抗は、該超音波洗浄操作直後の試験片を状態調整した試験片とした以外はJIS K6911(1995)に準拠して測定される。本発明において最外樹脂層における帯電防止剤の添加量は、2~30重量%が好ましく、5~25重量%がより好ましく、10~20重量%が更に好ましい。添加量が2重量%未満の場合は帯電防止効果が不十分となる虞があり、30重量%を超えると、最外樹脂層の物性低下や最外樹脂層の形成自体が困難になる虞があると共に、安価な積層発泡体の製造が困難となる。

【0068】本発明の積層発泡体は、前述したように、発泡シートと該発泡シートの少なくとも片面に積層されている1層以上からなる合成樹脂層とで構成される。該合成樹脂層が最外層として密度300 (g/L) 以上の最外樹脂層を有することが好ましい。このことにより、合成樹脂層による補強効果が期待でき、積層発泡体を加工して得られる箱、容器等の物理的強度が向上し、通い箱、収納箱として長期に亘り使用できるものとなる。

【0069】更に、本発明の積層発泡体においては、合成樹脂層が単層のポリオレフィン系樹脂層からなる場合、該ポリオレフィン系樹脂層を構成するポリオレフィン系樹脂のメルトフローレイト: X (g/10分) と、該ポリオレフィン系樹脂層の坪量: Y (g/m²) と、発泡シートの密度: d (g/L) とが、下記(1)~(4)式の関係を満足することが好ましい。

【0070】発泡シートの密度: d と、該ポリオレフィン系樹脂層を構成するポリオレフィン系樹脂のメルトフローレイト: X と、該ポリオレフィン系樹脂層の坪量: Y とが、下記(1)~(4)式の関係を満たしていない場合、剛性や圧縮強度等の物理的強度に優れると共に、表面固有抵抗が 1×10^{13} (Ω/\square) 以下の積層発泡体を得ることができない虞がある。

【0071】

$$\text{【数19】} \quad Y \leq 0.27 d X$$

【0072】該ポリオレフィン系樹脂層の坪量: Y (g/m²) が $0.27 (m^{-2} \cdot L \cdot 10 \text{分} \cdot g^{-1}) \cdot d (g/L) \cdot X (g/10 \text{分})$ により算出される値を超える場合には、坪量Y、メルトフローレイトXのポリオレフィン系樹脂層を密度dの発泡シートに積層接着できる条件下では、ポリオレフィン系樹脂層が積層される発泡シートの表層部の独立気泡率が低下することにより発泡シートの物性が低下し、その結果、得られる積層発泡体の物性も著しく低下する。また、発泡シートの独立気

$$\dots (1)$$

泡率の低下はポリオレフィン系樹脂層の部分的な剥離の原因にもなる。上記発泡シートの独立気泡率の低下は、発泡シートに積層可能な軟化或いは熔融状態のポリオレフィン系樹脂層の熱容量が大きすぎるため、その熱により発泡シートの気泡構造が破壊された結果と考えられる。尚、ポリオレフィン系樹脂層の坪量: Y (g/m²) は $0.23 d X$ 以下であることが更に好ましい。

【0073】

$$\text{【数20】} \quad 2 \leq X \leq 40$$

【0074】ポリオレフィン系樹脂層を構成するポリオレフィン系樹脂のメルトフローレイト: X が 2 g/10

$$\dots (2)$$

分未満の場合は、ポリオレフィン系樹脂層を発泡シートに積層する場合に良好な積層接着性を示す温度までポリ

オレフィン系樹脂層を構成する樹脂を加熱すると、該樹脂の熱容量が大きくなりその熱により発泡シートの独立気泡率が低下する虞があり、40 g/10分を超える場合は、表面平滑性等の外観が不十分となる虞がある。尚、ポリオレフィン系樹脂層を構成するポリオレフィン系樹脂のメルトフローレイト：Xは、好ましくは5～40 (g/10分)、更に好ましくは8～40 (g/10分)である。

【0075】

【数22】 $100 \leq d \leq 450$

【0078】発泡シートの密度：dが100 (g/L)未満の場合は、密度が低すぎ剛性や圧縮強度等の物理的強度が失われる虞があり、450 (g/L)を超える場合は積層発泡体の軽量性が失われる虞がある。尚、発泡シートの密度：dは、好ましくは120～300 (g/L)である。

【0079】本発明の積層発泡体における合成樹脂層は、最外層にポリオレフィン系樹脂層を有する多層の合成樹脂層、即ち2層以上の樹脂層積層体として合成樹脂層を構成することにより、剛性等の物理的強度に特に優れる効果、ポリマータイプの帯電防止剤等の機能性添加剤を最低限最外樹脂層のみに含有させることにより、機能性添加剤の使用量が少なくとも帯電防止効果等の十分な機能性添加剤の効果を兼備することができるため好ましい。

【0080】複数層のポリオレフィン系樹脂層からなる合成樹脂層が積層されている積層発泡体においては、該合成樹脂層の坪量が80～380 (g/m²)、最外樹

【数23】 $Y' \leq 0.27 d X'$ (5)

【0082】

【数24】 $5 \leq X' \leq 40$ (6)

【0083】

【数25】 $70 \leq Y' \leq 300$ (7)

【0084】

【数26】 $100 \leq d \leq 450$ (8)

【0085】上記(5)～(8)式の意味としては、複数層のポリオレフィン系樹脂層からなる合成樹脂層のうち該内層の坪量：Y'を70 g/m²未満にした場合には、多層の合成樹脂層を積層することにより十分な剛性を得るという目的を達成できない虞があり、Y'が300 g/m²と大きすぎると積層発泡体の軽量性が失われる虞がある。また該内層を構成するポリオレフィン系樹脂のメルトフローレイト：X'が小さすぎる場合には、内層の発泡シートへの積層接着時の熱容量が大きくなり、発泡シートの独立気泡率が低下する虞があり、X'

【数21】 $5 \leq Y < 80$ (3)

【0076】ポリオレフィン系樹脂層の坪量：Yが5 g/m²未満の場合は、帯電防止性能、剛性などの機能を十分に発揮し得るポリオレフィン系樹脂層の形成が困難になる虞があり、Yが大きすぎると積層発泡体の軽量性が失われる虞がある。尚、ポリオレフィン系樹脂層の坪量：Yは、好ましくは5～40 (g/m²)、更に好ましくは5～30 (g/m²)である。

【0077】

..... (4)

樹脂層の坪量が5 (g/m²)以上、80 (g/m²)未満であり、発泡シートの密度：d (g/L)と、該多層の樹脂層からなる合成樹脂層のうち最外樹脂層以外の内層(1層または2層以上のポリオレフィン系樹脂層からなる内層)を構成するポリオレフィン系樹脂のメルトフローレイト：X' (g/10分)と、該内層の坪量：Y' (g/m²)とが、下記(5)～(8)式の関係を満足することが好ましい。尚、合成樹脂層の坪量が80 (g/m²)未満の場合には、剛性等の物理的強度が不十分となる虞があり、一方、合成樹脂層の坪量が380 (g/m²)を超える場合には、積層発泡体の軽量性が失われる虞がある。また、最外樹脂層の坪量が小さすぎる場合は、帯電防止性能や剛性を十分に発揮できない可能性が有る。一方、最外樹脂層の坪量が80 (g/m²)を超える場合には積層発泡体の軽量性が不十分となる虞があり、積層発泡体に機能性を付加する帯電防止剤などの機能性添加剤の使用量も多くなってしまう。

【0081】

が40 (g/10分)を超える場合には、最外樹脂層の坪量にも因るが積層発泡体の外観不良が発生する虞がある。その他、上記(5)及び(8)式の意味は前記(1)及び(4)式と同様である。

【0086】尚、内層の坪量：Y' (g/m²)は0.23 d X'以下であることが更に好ましい。又、内層のメルトフローレイト：X'は、好ましくは8～40 (g/10分)、更に好ましくは10～40 (g/10分)であり、内層の坪量：Y'は、好ましくは80～300 (g/m²)、更に好ましくは100～250 (g/m

2)である。又、上記発泡シートの密度： d は、好ましくは120～300 (g/L)である。

【0087】本明細書における樹脂層のメルトフローレイトの測定は、樹脂層を構成する基材樹脂の種類に関わらず、JIS K7210 (1999)のA法に準拠して、試験温度230℃、荷重21.18Nで測定するものとする。尚、合成樹脂層が気泡を含む場合は、該合成樹脂層のメルトフローレイトは、ヒートプレスにより該合成樹脂層から気泡を脱泡させる操作を行い、得られたサンプルからメルトフローレイトを求める。

【0088】本明細書における樹脂層の坪量は、発泡シートの押出方向に対して垂直な積層発泡体の幅方向の断面の厚みを顕微鏡により等間隔に10点撮影を行い、撮影した写真より各層の厚みを測定し、得られた測定値の算術平均値を各層の厚みとし、樹脂層の厚みに該樹脂層を構成している基材樹脂の密度を乗じ、単位換算を行なって求められる。当然のことながら、樹脂層がフィラーを多量に含有している場合は樹脂層の基材樹脂の密度の代わりにフィラー含有樹脂層の密度を乗じ、単位換算を行い樹脂層の坪量 (g/m²) を求める。

【0089】本明細書における発泡シートの密度： d の測定は、次のように行なうものとする。予め前述した方法により、積層発泡体の厚み、合成樹脂層の厚みを測定し、更に積層発泡体の坪量を測定する。求めた積層発泡体の厚みから、合成樹脂層の厚みを減じた厚みを発泡シートの厚みとする。

【0090】次に、前記方法にて合成樹脂層の坪量 (g/m²) を求める。次に前記発泡積層体の坪量より合成樹脂層の坪量を減じたものを発泡シートの坪量とする。この発泡シートの坪量 (g/m²) を前記の発泡シートの厚み (mm) で除した値を単位換算し、発泡シートの密度 (g/L) とする。

【0091】本発明の積層発泡体においては、最外樹脂

【数28】 $2 \leq \beta \leq 40$

【0095】最外樹脂層等を構成する基材樹脂のメルトフローレイト： β が2 (g/10分) 未満の場合は、最外樹脂層の粘度が高すぎて帯電防止剤のネットワーク構造を形成できなくなる虞があり、40 (g/10分) を超える場合は、最外樹脂層等の粘度が低すぎて帯電防止剤のネットワーク構造を形成できなくなる虞がある。尚、最外樹脂層等を構成する基材樹脂のメルトフローレイト： β は、更に3～35 (g/10分)、特に8～35 (g/10分) であることが好ましい。

【0096】

【数29】 $0.5 \leq \alpha/\beta$ (11)

【0097】 α/β が0.5未満の場合は、最外樹脂層等を構成する基材樹脂に対して帯電防止剤の粘度が高すぎるため、帯電防止剤のネットワーク構造を形成できなくなる虞がある。一方、 α/β が大きすぎる場合は、帯

層に帯電防止剤を含有させ、且つ該帯電防止剤のメルトフローレイト： α (g/10分) と、最外樹脂層を構成する基材樹脂のメルトフローレイト： β (g/10分) とが下記(9)～(11)式の関係を満足していることが、良好なネットワーク構造を形成する上で好ましい。尚、共押し法により最外樹脂層を形成する場合は、他の方法と比べて該ネットワーク構造を形成することが難しいため、特に下記(9)～(11)式の関係を満足することが有効である。また、最外樹脂層以外の合成樹脂層や発泡シートに帯電防止剤を含有させる場合も、帯電防止剤のメルトフローレイト： α と該合成樹脂層や発泡シートを構成する基材樹脂のメルトフローレイトとの関係は、最外樹脂層を構成する基材樹脂のメルトフローレイト： β と同様に下記(9)～(11)式の関係を満足していることが好ましい。

【0092】

【数27】 $10 \leq \alpha$ (9)

【0093】帯電防止剤のメルトフローレイト： α が10 (g/10分) 未満の場合は、帯電防止剤の粘度が高すぎて帯電防止剤のネットワーク構造を形成できなくなる虞がある。尚、帯電防止剤のメルトフローレイト： α は、更に10～150 (g/10分) であることが好ましい。また、該帯電防止剤はメルトフローレイト α の値が極めて大きな値であっても使用可能であるため、メルトフローレイトの大きな帯電防止剤の場合は、該メルトフローレイトの測定時には溶融した帯電防止剤が一瞬の内に測定装置のオリフィスから排出されてしまい正確にメルトフローレイトを測定することが困難となる場合があるが、測定回数を増やして平均値より定量することにより考察すると、該メルトフローレイト： α の上限は、おおむね500 (g/10分) である。

【0094】

..... (10)

帯電防止剤の種類によっては、帯電防止剤と最外樹脂層等を構成する基材樹脂の粘度差が大きすぎて、帯電防止剤が凝集し、帯電防止剤のネットワーク構造を形成できなくなる虞がある。またポリマータイプの帯電防止剤がアイオノマー系のものの場合は、(α/β)を特に2.5以上とすることが好ましい。尚、上記 α/β の値は、更に1～250、特に1～150であることが好ましい。また、合成樹脂層が複数層から構成されている場合、最外樹脂層以外の層を構成する基材樹脂のメルトフローレイトは、最外樹脂層を構成する基材樹脂のメルトフローレイトと同等もしくはそれ以上あることが発泡シートの独立気泡率低下を防ぐ上で好ましい。本明細書における帯電防止剤のメルトフローレイトの測定は、帯電防止剤の種類に関わらず、JIS K7210 (1999)のA法に準拠して、試験温度230℃、荷重21.18N

で測定するものとする。尚、融点が230℃を超える帯電防止剤の場合には、上記(9)～(11)式の間係を適用することはできない。

【0098】

【実施例】本発明を実施例により、さらに具体的に説明する。

【0099】実施例、比較例に使用した樹脂、および帯電防止剤を下記に示す。尚、以下の実施例、比較例においてはメルトフローレイトを単にMFRと表す。

【0100】ポリプロピレン系樹脂

樹脂I：(株)グランドポリマー社製、商品名J704U(プロピレン-エチレンブロック共重合体)(MFR：5g/10分)

樹脂II：サンアロマー(株)社製、商品名SD632の回収原料(プロピレン系樹脂)(MFR：10g/10分)

樹脂III：サンアロマー(株)社製、商品名PM870A(プロピレン-エチレンブロック共重合体)(MFR：17g/10分)

樹脂IV：出光石油化学(株)社製、商品名J950HP(プロピレン-エチレンブロック共重合体)(MFR：32g/10分)

樹脂V：出光石油化学(株)社製、商品名E200GP(プロピレン単重合体)(MFR：2g/10分)

樹脂VI：サンアロマー(株)社製、商品名SD632(プロピレン系樹脂)(MFR：3.2g/10分、結晶化温度：134℃)

樹脂VII：出光石油化学(株)社製、商品名J750HP(プロピレン-エチレンブロック共重合体)(MFR：14g/10分)

【0101】ポリマータイプ帯電防止剤

樹脂A：チバ・スペシャルティ・ケミカルズ株式会社製、商品名IRGASTAT P18(ポリエーテルエステルアミド+ポリアミド)(MFR：17g/10分、融点：180℃、結晶化温度：143℃)

樹脂B：チバ・スペシャルティ・ケミカルズ株式会社製、商品名IRGASTAT P22(ポリエーテルエステルアミド+ポリアミド)(MFR：21g/10分、融点：220℃、結晶化温度：172℃)

樹脂C：三洋化成工業株式会社製、商品名ジェイスタット3180(ポリエーテルエステルアミド)(MFR：70g/10分、融点：160℃、結晶化温度：117℃)

樹脂D：三井・デュボン・ポリケミカルズ株式会社製、商品名SD100(エチレン系アイオノマー)(MFR：20g/10分、融点：92℃、結晶化温度：64℃)

樹脂E：第一工業製薬株式会社製、商品名レオレックスAS170(4級アンモニウム塩基含有共重合体)(MFR：100g/10分以上、融点：80℃)

樹脂F：三洋化成工業株式会社製、商品名ベレスタット300(ポリエーテル-ポリプロピレンブロック共重合体)(MFR：100g/10分以上、融点：136℃、結

晶化温度：81℃)

【0102】界面活性剤系帯電防止剤

G：理研ビタミン株式会社製、商品名S-100(グリセリンモノステアレート)(融点：65℃)

本明細書において樹脂等の融点は、JIS K7121-1987に準拠して求められる融解温度のことである。尚、DSC曲線においてピークが2つ以上現れる場合は、ピーク面積の最も大きいピークの頂点温度を融点とする。

【0103】実施例1、2、4～7、比較例1～5

積層発泡体の発泡シート製造用の押出機として、直径90mmと直径120mmの2台の押出機からなるタンデム押出機を使用し、最外樹脂層以外の合成樹脂層(以下、内層という。)形成用の押出機として直径50mmの押出機を使用し、また最外樹脂層形成用の押出機として直径40mmの押出機を使用し、発泡シートと内層と最外樹脂層との積層し共押し出するために、直径140mm、間隔1.0mmの環状ダイを用いた。

【0104】先ず、該発泡シートを形成するために、ポリプロピレン系樹脂(樹脂VI)100重量部に対して、気泡調整剤(融点：109℃、MFR：5.4g/10分の低密度ポリエチレン樹脂100重量部に対してクエン酸ナトリウム6重量部を配合したもの)を0.5重量部配合して、直径90mmの押出機の原料投入口に該ポリプロピレン系樹脂(樹脂VI)と気泡調整剤とを供給し、加熱混練し、約200℃に調整された熔融樹脂混合物とし、該熔融樹脂混合物にノルマルブタン70重量%とイソブタン30重量%からなる混合発泡剤を樹脂VI100重量部に対して1.2～2.8重量部となるように圧入し、次いで前記直径90mmの押出機の下流側に連結された直径120mmの押出機に供給し発泡性熔融樹脂混合物を得た。

【0105】一方、内層を構成する表2に示す樹脂を直径50mmの押出機に供給し溶融混練して溶融樹脂を得た。また最外樹脂層を構成する表2に示す樹脂と帯電防止剤との樹脂混合物を直径40mmの押出機より溶融混練することにより帯電防止溶融樹脂を得た。得られた夫々の発泡性溶融樹脂混合物、溶融樹脂及び帯電防止溶融樹脂を合流ダイ中へ供給し、帯電防止溶融樹脂、内層を構成する溶融樹脂、発泡性溶融樹脂混合物を積層合流させて環状ダイから共押し出し、外側から最外樹脂層/内層/発泡シート/内層/最外樹脂層の順に積層された筒状積層発泡体を形成した。押し出された筒状積層発泡体を冷却された円筒に沿わせて引き取りながら筒状物を切り開いた後、その積層発泡体の両面を加熱炉で加熱して平板化し目的の積層発泡体を得た。

【0106】表2に、積層発泡体の内層および最外樹脂層を構成する樹脂等の種類、MFR、積層厚みを示し、表1に樹脂層を構成するポリプロピレン系樹脂組成物層のMFR(X又はX')、坪量(Y又はY')および積層発泡体の

厚み (mm)、独立気泡率 (%)、表面固有抵抗 (Ω/\square)、超音波洗浄後の表面固有抵抗 (Ω/\square)、発泡シートの密度 (g/L) を示した。尚、参考のために押出发泡直後の表面固有抵抗 (押出发泡直後の積層発泡体を状態調整した試験片とした以外は JIS K6911 (1995) に準拠して測定される表面固有抵抗 (Ω/\square)) も併せて表 2 に示した。

【0107】実施例 3

内層を設けず、最外樹脂層を構成する樹脂として表 2 に示す種類のものを使用した以外は実施例 1 と同様にして積層発泡体を得た。実施例 1 と同様に得られた積層発泡体の物性等を表 1 及び 2 に示した。

【0108】実施例 8、9

合流ダイを使用せずそれ以外は実施例 1 と同様にして、発泡シートのみを得た。次いで最外樹脂層として表 2 に示す樹脂混合物を T ダイによる押出ラミにて該発泡シートの片面に積層し、その後、片面に最外樹脂層が積層された発泡シートを表裏反転させ他方の片面に、同様に T ダイにて最外樹脂層を積層した。実施例 1 と同様に得られた積層発泡体の物性等を表 1 及び 2 に示した。

【0109】実施例 10~13

発泡剤の添加量を増やして発泡シートの密度を 130 g/L とした以外は実施例 1 と同様にして積層発泡体を得

た。実施例 1 と同様に得られた積層発泡体の物性等を表 1 及び 2 に示した。

【0110】実施例 14~16

内層を設けず、最外樹脂層を構成する樹脂として表 2 に示す種類のものを使用し、直径 9.8mm の環状ダイを用いた以外は実施例 1 と同様にして積層発泡体を得た。ただし平板化はせず、電気、電子部品搬送用トレイ成形用シートとしてロール状に巻き取った。実施例 1 と同様に得られた積層発泡体の物性等を表 1 及び 2 に示した。

【0111】実施例 17

発泡シートを構成するポリプロピレン系樹脂に、樹脂 VI / 樹脂 VII = 30 / 70 (重量比) (尚、樹脂 VI / 樹脂 VII = 30 / 70 (重量比) 混合樹脂の結晶化温度は 133℃ であった。) を使用した以外は実施例 14~16 と同様にして積層発泡体を得た。実施例 1 と同様に得られた積層発泡体の物性等を表 1 及び 2 に示した。

【0112】実施例 1、2、4~7、10~13、比較例 1~5 は発泡シートの両面に内層および最外樹脂層が積層された 5 層構造の積層発泡体であり、実施例 3、8、9、14~17 は発泡シートの両面に最外樹脂層のみが積層された 3 層構造の積層発泡体である。

【0113】

【表 1】

		樹脂層		積層発泡体						積層方法
		MFR (X又はX') (g/10分)	坪量 (Y又はY') (g/m ²)	発泡シート 密度(d) (g/L)	厚み (mm)	独立 気泡率 (%)	表面固有抵抗 (Ω/\square)	押出发泡直後の 表面固有抵抗 (Ω/\square)	超音波洗浄後の 表面固有抵抗 (Ω/\square)	
実施例	1	5	175	225	3.1	87	1.5×10^{12}	2.4×10^{12}	2.8×10^{12}	共押出(両面)
	2	10	135	130	4.0	85	6.6×10^{10}	7.5×10^{10}	7.0×10^{10}	同上
	3	12	37	112	4.0	83	2.3×10^{11}	1.7×10^{11}	1.7×10^{11}	同上
	4	17	135	130	4.0	87	5.8×10^{11}	6.0×10^{11}	7.0×10^{11}	同上
	5	10	同上	130	4.0	73	3.2×10^{12}	3.5×10^{12}	3.2×10^{12}	同上
	6	10	同上	130	4.0	88	4.3×10^{12}	5.5×10^{12}	6.0×10^{12}	同上
	7	32	同上	130	4.0	87	6.2×10^{12}	7.4×10^{12}	8.2×10^{12}	同上
	8	3	60	150	2.0	85	3.0×10^{12}	2.0×10^{12}	1.8×10^{12}	押出ラミ(両面)
	9	同上	同上	150	2.0	85	6.5×10^{12}	6.5×10^{12}	6.0×10^{12}	同上
	10	5	175	130	5.0	80	1.5×10^{12}	2.1×10^{12}	2.5×10^{12}	共押出(両面)
	11	5	135	同上	4.0	82	9.5×10^{10}	9.0×10^{10}	9.0×10^{10}	同上
	12	10	同上	同上	同上	85	6.7×10^{10}	8.0×10^{10}	7.5×10^{10}	同上
	13	17	同上	同上	同上	87	4.4×10^{10}	4.0×10^{10}	5.1×10^{10}	同上
	14	14	7	280	1.5	92	5.0×10^{11}	4.2×10^{11}	4.8×10^{11}	同上
	15	14	13	275	1.2	94	4.5×10^{11}	5.2×10^{11}	4.5×10^{10}	同上
	16	14	25	280	2.0	90	8.5×10^{10}	9.8×10^{10}	1.2×10^{11}	同上
	17	14	13	275	1.2	98	4.2×10^{11}	5.1×10^{11}	5.9×10^{11}	同上
比較例	1	10	135	130	4.0	85	2.8×10^{10}	5.0×10^{10}	5.3×10^{10}	共押出(両面)
	2	10	135	130	4.0	84	4.3×10^{10}	5.0×10^{10}	4.5×10^{10}	同上
	3	32	同上	130	4.0	84	6.0×10^{10}	6.8×10^{10}	6.8×10^{10}	同上
	4	10	同上	130	4.0	85	4.5×10^{10}	4.1×10^{10}	4.5×10^{10}	同上
	5	10	同上	130	4.0	85	5.0×10^{10}	4.2×10^{10}	6.2×10^{10}	同上

【0114】

【表 2】

	最外樹脂層以外の合成樹脂層 (内層)			最外樹脂層				積層発泡体各層の坪量 (最外樹脂層/内層/発泡シート/ 内層/最外樹脂層) (g/m ²)	
	種類	MFR (g/10分)	積層厚み (μm)	種類	帯電防止剤 添加量 (重量%)	MFR α/β (g/10分)	積層厚み (μm)		
実施例	1	樹脂Ⅰ	5	194	樹脂Ⅰ/樹脂Ⅰ	15	17/5	28	25/175/600/175/25
	2	樹脂Ⅱ*	10	150	樹脂Ⅰ/樹脂Ⅱ	同上	17/10	同上	25/135/480/135/25
	3	—	—	同上	同上	同上	同上	40	370/440/0/37
	4	樹脂Ⅱ	17	150	樹脂Ⅰ/樹脂Ⅲ	同上	17/17	28	25/135/480/135/25
	5	樹脂Ⅱ*	10	同上	樹脂Ⅱ/樹脂Ⅱ*	15	21/10	同上	同上
	6	樹脂Ⅱ*	同上	同上	樹脂Ⅲ/樹脂Ⅱ	20	70/10	同上	同上
	7	樹脂Ⅳ	32	同上	樹脂Ⅲ/樹脂Ⅳ	同上	70/32	同上	同上
	8	—	—	—	樹脂Ⅰ/樹脂Ⅴ	15	17/2	55	50/0/230/0/50
	9	—	—	—	樹脂Ⅳ/樹脂Ⅴ	20	20/2	同上	同上
	10	樹脂Ⅰ	5	194	樹脂Ⅰ/樹脂Ⅰ	15	17/5	28	25/175/600/175/25
	11	樹脂Ⅰ*	5	150	樹脂Ⅴ/樹脂Ⅰ	同上	100以上/5	同上	25/135/480/135/25
	12	樹脂Ⅱ*	10	同上	樹脂Ⅴ/樹脂Ⅱ	同上	100以上/10	同上	同上
	13	樹脂Ⅲ*	17	同上	樹脂Ⅴ/樹脂Ⅲ	同上	100以上/17	同上	同上
	14	—	—	—	樹脂Ⅴ/樹脂Ⅵ	20	100以上/14	8	70/435/0/7
	15	—	—	—	樹脂Ⅴ/樹脂Ⅶ	20	100以上/14	15	130/324/0/13
	16	—	—	—	樹脂Ⅴ/樹脂Ⅵ	20	100以上/14	28	25/0/550/0/25
	17	—	—	—	樹脂Ⅴ/樹脂Ⅶ	20	100以上/14	15	130/324/0/13
比較例	1	樹脂Ⅱ*	10	150	樹脂Ⅰ/樹脂Ⅱ	1	17/10	28	25/135/480/135/25
	2	樹脂Ⅱ	10	150	樹脂Ⅳ/樹脂Ⅱ	20	20/10	同上	25/135/480/135/25
	3	樹脂Ⅳ	32	同上	樹脂Ⅳ/樹脂Ⅳ	同上	20/32	同上	同上
	4	樹脂Ⅱ	10	同上	樹脂Ⅴ/樹脂Ⅱ	15	100以上/10	同上	同上
	5	樹脂Ⅱ*	同上	同上	G/樹脂Ⅱ*	0.8	—/10	同上	同上

*: 熱可塑性エラストマー (エチレン-オクテンランダム共重合体, MFR=10.6 g/10分) 「ダウケミカル社製」

商品名: アフィニティー EG8200 を更に 2.5 重量% 添加

【0115】表3に、発泡シートの密度と、樹脂層のメルトフローレートと、樹脂層の坪量と、前記(1)式における0.27dXの数値又は前記(5)式における

0.27dX'の数値を一覧表にして示す。

【0116】

【表3】

		MFR (X又はX') (g/10分)		発泡シート 密度(d) (g/L)	0.27dX 又は 0.27dX'	樹脂層の坪量 (Y又はY') (g/m ²)	
		X	X'			Y	Y'
実施例	1	—	5	225	304	—	175
	2	—	10	130	351	—	135
	3	12	—	112	363	37	—
	4	—	17	130	597	—	135
	5	—	10	130	351	—	135
	6	—	10	130	351	—	135
	7	—	32	130	1123	—	135
	8	3	—	150	122	50	—
	9	3	—	150	122	50	—
	10	—	5	130	176	—	175
	11	—	5	130	176	—	135
	12	—	10	130	351	—	135
	13	—	17	130	597	—	135
	14	14	—	290	1096	7	—
	15	14	—	275	1040	13	—
	16	14	—	280	1058	25	—
	17	14	—	275	1040	13	—
比較例	1	—	10	130	351	—	135
	2	—	10	130	351	—	135
	3	—	32	130	1123	—	135
	4	—	12	130	351	—	135

【0117】

【発明の効果】以上説明したように、本発明のポリオレフィン系樹脂積層発泡体は、ポリオレフィン系樹脂発泡

シートの少なくとも片面に密度300 (g/L) 以上の合成樹脂層が積層されてなる積層発泡体において、該合成樹脂層が最外層として密度300 (g/L) 以上のポ

リオレフィン系樹脂層を有する1層以上のものであり、該ポリオレフィン系樹脂層には表面固有抵抗が 1×10^{13} (Ω/\square) 以下となるようにポリマータイプの帯電防止剤が含有されているので、成形直後から十分な帯電防止効果を発現し、洗浄によって帯電防止効果が損なわれることがなく、リターナブルな用途に好適に使用することができる。

【0118】本発明のポリオレフィン系樹脂積層発泡体は、合成樹脂層が単層のポリオレフィン系樹脂層からなり、該ポリオレフィン系樹脂発泡シートの密度と、該単層のポリオレフィン系樹脂層を構成しているポリオレフィン系樹脂のメルトフローレイトと、該単層のポリオレフィン系樹脂層の坪量とが、特定の関係を満足する場合に、発泡シートの独立気泡率が低下することなく良好な発泡層が形成され、剛性や圧縮強度等の物理的強度に優れるものとなすと共に、機能性添加剤を少量、ポリオレフィン系樹脂層に添加することにより帯電防止性能や抗菌性能等の機能性を付加した安価な本発明のポリオレフィン系樹脂積層発泡体を提供することができる。また、合成樹脂層の坪量が $80 \sim 380$ (g/m^2) であり、且つ複数層のポリオレフィン系樹脂層からなり、該複数層のポリオレフィン系樹脂層の内、最外層を構成しているポリオレフィン系樹脂層の坪量が 5 (g/m^2) 以上、 80 (g/m^2) 未満であり、該ポリオレフィン系樹脂発泡シートの密度と、該複数層のポリオレフィン系

樹脂層のうち該最外層以外の樹脂層からなる内層を構成しているポリオレフィン系樹脂のメルトフローレイトと、該内層の坪量とが、特定の関係を満足する場合に、発泡シートの独立気泡率を低下させることなく十分な厚みを有する合成樹脂層を形成することができ、曲げ強度等の物理的強度に特に優れると共に、機能性添加剤を少量、ポリオレフィン系樹脂層に添加することにより帯電防止性能や抗菌性能等の機能性を付加した安価な本発明のポリオレフィン系樹脂積層発泡体を提供することができる。

【0119】本発明においては、ポリオレフィン系樹脂発泡シートの基材樹脂、及びポリオレフィン系樹脂層の基材樹脂としてポリプロピレン系樹脂を使用すると、剛性等の物理的強度や耐熱性に優れるポリオレフィン系樹脂積層発泡体を提供することができる。

【0120】本発明においては、ポリマータイプの帯電防止剤としてポリエーテルエステルアミドやポリエーテルを主成分とするものを使用すると、表面固有抵抗が 1×10^{13} (Ω/\square) 以下のポリオレフィン系樹脂層を容易に形成することができ、特にポリオレフィン系樹脂層の基材樹脂がポリプロピレン系樹脂の場合、ポリマータイプの帯電防止剤の主成分がポリエーテルとポリプロピレンとの共重合体またはポリエーテルとポリプロピレンとの混合物を使用すると更に容易に形成することができる。

フロントページの続き

(72)発明者 角田 博俊
栃木県鹿沼市さつき町10-3 株式会社ジ
ェイエスピー鹿沼研究所内

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(72)Inventor : MORITA KAZUHIKO

MUROI TAKASHI

TSUNODA HIROTOSHI

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(54) POLYOLEFINIC RESIN LAMINATED FOAM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a polyolefinic resin laminated foam having sufficient antistatic effect immediately after molding, not damaging antistatic effect by washing, usable for a returnable use and having sufficient strength.

SOLUTION: The polyolefinic resin laminated foam is formed by laminating a synthetic resin layer on at least the single surface of a polyolefinic resin foamed sheet and the synthetic resin layer has a polyolefinic resin layer as an outermost layer, and a polymer type antistatic agent is added to the polyolefinic resin layer so that surface resistivity becomes $1 \times 10^{13} (\Omega/(\text{square}))$ or less.

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CLAIMS

[Claim(s)]

[Claim 1] Polyolefine system resin laminating foam which this synthetic-resin layer is the thing of one or more layers which has a polyolefine system resin layer in an outermost layer of drum in the laminating foam which comes to carry out the laminating of the synthetic-resin layer to at least one side of a polyolefine system resin foaming sheet, and is characterized by the polymer type antistatic agent containing so that surface specific resistance may become this polyolefine system resin layer below 1×10^{13} (Ω/cm).

[Claim 2] Polyolefine system resin laminating foam which this synthetic-resin layer is the thing of one or more layers which has a polyolefine system resin layer in an outermost layer of drum in the laminating foam which comes to carry out the laminating of the synthetic-resin layer to at least one side of a polyolefine system resin foaming sheet, and is characterized by the antistatic agent containing in this polyolefine system resin layer so that the surface specific resistance after ultrasonic cleaning by ethanol may be set to 1×10^8 to 1×10^{13} (Ω/cm).

[Claim 3] A synthetic-resin layer consists of a polyolefine system resin layer of a monolayer. Consistency: η of this polyolefine system resin foaming sheet (g/L), The melt flow rate of the polyolefine system resin which constitutes the polyolefine system resin layer of this monolayer: X (g / 10 minutes), Basis weight of the polyolefine system resin layer of this monolayer: Polyolefine system resin laminating foam according to claim 1 or 2 to which Y (g/m²) is characterized by satisfying the relation of following the (1) - (4) type.

[Equation 1] $Y \leq 0.27dX$ (1)

[Equation 2] $2 \leq X \leq 40$ (2)

[Equation 3] $5 \leq Y \leq 80$ (3)

[Equation 4] $100 \leq d \leq 450$ (4)

[Claim 4] It consists of a polyolefine system resin layer which the basis weight of a synthetic-resin layer is 80-380 (g/m²), and are. The basis weight of the polyolefine system resin layer which constitutes the outermost layer of drum among the polyolefine system resin layers of these two or more layers is under 80 (g/m²) more than five (g/m²). Consistency: η of this polyolefine system resin foaming sheet (g/L), The melt flow rate of the polyolefine system resin which constitutes the inner layer which consists of resin layers other than this outermost layer of drum among the polyolefine system resin layers of these two or more layers: X' (g / 10 minutes), Basis weight of this inner layer: Polyolefine system resin laminating foam according to claim 1 or 2 to which Y' (g/m²) is characterized by satisfying the relation of following the (5) - (8) type.

[Equation 5] $Y' \leq 0.27dX'$ (5)

[Equation 6] $5 \leq X' \leq 40$ (6)

[Equation 7] $70 \leq Y' \leq 300$ (7)

[Equation 8] $100 \leq d \leq 450$ (8)

[Claim 5] Polyolefine system resin laminating foam according to claim 1 to 4 characterized by the base material resin which constitutes a polyolefine system resin foaming sheet being a polypropylene resin.

[Claim 6] Polyolefine system resin laminating foam according to claim 1 to 5 characterized by

the base material resin which constitutes a polyolefine system resin layer being a polypropylene resin.

[Claim 7] Polyolefine system resin laminating foam according to claim 1 to 6 to which crystallization temperature of an antistatic agent is characterized by being the following ($T_c + 40$ degree C) on the basis of the crystallization temperature (T_c) of the base material resin which constitutes a polyolefine system resin foaming sheet.

[Claim 8] Polyolefine system resin laminating foam according to claim 1 to 7 characterized by the principal component of an antistatic agent being a polyether ester amide.

[Claim 9] Polyolefine system resin laminating foam according to claim 1 to 7 characterized by the principal component of an antistatic agent being a polyether.

[Claim 10] Polyolefine system resin laminating foam according to claim 1 to 7 characterized by the principal component of an antistatic agent being the copolymer of a polyether and polypropylene, or the mixture of a polyether and polypropylene.

[Claim 11] Polyolefine system resin laminating foam according to claim 1 to 10 characterized by the antistatic agent containing two to 30% of the weight.

[Claim 12] Polyolefine system resin laminating foam according to claim 1 to 11 characterized by the polyolefine system resin layer which constitutes the outermost layer of drum containing the antimicrobial agent.

[Claim 13] Polyolefine system resin laminating foam according to claim 1 to 12 characterized by for the thickness of the whole laminating foam being 0.5–10mm, and the rate of a closed cell of laminating foam being 60% or more.

[Claim 14] Polyolefine system resin laminating foam according to claim 1 to 13 characterized by obtaining laminating foam by the co-extrusion method.

[Claim 15] Polyolefine system resin laminating foam according to claim 1 to 14 characterized by the ratio (α/β) of the melt flow rate α of an antistatic agent (g / 10 minutes) and the melt flow rate β of polyolefine system resin which constitute the polyolefine system resin layer containing an antistatic agent being 0.5 or more.

[Translation done.]

muscle and a continuation layer is formed in it. And the approach of carrying out the heat lamination of the film which manufactured at the extrusion lamination method which can form the continuation layer of the antistatic agent which distributed in the shape of a muscle comparatively easily from the reason for being easy to form the antistatic-agent content resin layer to which orientation of the constraint on the temperature of melting resin was carried out small and moderately at the time of melting kneading of an antistatic agent or the laminating to the foaming sheet of an antistatic-agent content resin layer compared with a co-extrusion method, or another process is also employable.

[0014] Manufacture by the extrusion-foaming method of the foaming sheet in this invention is explained in full detail. This foaming sheet can be obtained by extruding and foaming to the bottom of low voltage through the die which attached this melting kneading object at the head of an extruder, after kneading with a foaming agent, while carrying out melting of the base material resin within an extruder. In order to form as sheet-like foam, the approach of carrying out [the approach] extrusion foaming, and obtaining tube-like foam, clearing this tube subsequently, and making it into the shape of a sheet from the lip of this die, is preferably adopted using the circular die which has an annular lip. In addition, it is also possible to manufacture by the approach of replacing with a circular die and extruding from flat dies, such as a T die.

[0015] The base material resin which constitutes the foaming sheet of this invention is polyolefine system resin, and a polypropylene resin, polyethylene system resin, etc. are mentioned as this polyolefine system resin. Polyolefine system resin is rich in flexibility, and it excels in physical reinforcement, such as tensile strength, and has chemical resistance, and it is that of extrusion-foaming nature proper *****; and is the raw material which was excellent as base material resin which constitutes the foaming sheet of this invention, and the polypropylene resin which is excellent in rigidity or thermal resistance also in polyolefine system resin is preferably used especially in this invention.

[0016] As the above-mentioned polypropylene resin, a propylene homopolymer or the copolymer of a propylene and other olefins which can be copolymerized is mentioned. As other copolymerization components in which a propylene and copolymerization are possible, the alpha olefin of ethylene or carbon numbers 4-10, such as ethylene, 1-butene, an isobutylene, 1-pentene, a 3-methyl-1-butene, 1-hexene, 3, a 4-dimethyl-1-butene, 1-heptene, and a 3-methyl-1-hexene, is illustrated, for example. moreover — even if the above-mentioned copolymer is a random copolymer — a block copolymer — you may be — further — again — duality — you may be not only a copolymer but a ternary polymerization object. Moreover, these polypropylene resins are independent, or two or more sorts can be mixed and used for them.

[0017] When using the above-mentioned copolymer as base material resin which constitutes a foaming sheet, it is desirable that the copolymerization component contains 25 or less % of the weight in a copolymer especially at 15 or less % of the weight of a rate. Moreover, the lower limit with the desirable copolymerization component contained in a copolymer is 0.3 % of the weight.

[0018] That in which melting tension contains a high polypropylene resin as suitable resin for extrusion foaming also in the above-mentioned polypropylene resin as compared with a general polypropylene resin is desirable, and the polypropylene resin which contains a polypropylene resin with this high melting tension 15 to 50% of the weight especially is desirable from having the manufacturing cost, the recycle nature, and extrusion-foaming **** of this invention laminating foam. With in addition, a polypropylene resin with this high melting tension As

[indicate / for example, / by the patent registration No. 2521388 and JP,7-53797,A] (1) The polypropylene which has less than one branching characteristic and remarkable strain-hardening elongation viscosity, (2) [whether (a) Z average molecular weight (M_z) is 1.0×10^6 or more and] Or the ratio (M_z/M_w) of Z average molecular weight (M_z) and weight average molecular weight (M_w) is 3.0 or more. (b) And [whether the balanced compliance J_0 is more than $1.2 \times 10^{-3} \text{ m}^2/\text{N}$ and] Or the thing whose shearing distortion recovery S_r/S per unit stress is more than per second $5 \text{ m}^2/\text{N}$, (3) the compound containing a radical polymerization nature monomer, radical polymerization initiators, additives, such as styrene, etc. The polypropylene resin by which refining was carried out by a polypropylene resin's fusing and carrying out melting kneading more

regin obtained by carrying out melting kneading of (4) polypropylene regins, an isoprene monomer, and the radical polymerization initiator is mentioned.

[0019] Moreover, what has the rate of an insoluble solution component to an ebullition xylene that it is low also in a polypropylene regin with the above-mentioned high melting tension is desirable.

[0020] The rate of the above-mentioned insoluble solution component makes a sample the polypropylene regin which weighed weight precisely, or its foaming sheet. After paying a sample into about 145-degree C xylene and carrying out heating reflux for 8 hours, it filters promptly at the wire gauze of 100 meshes. Subsequently, after drying the ebullition xylene insoluble solution component which remained on the wire gauze in 20-degree C oven for 24 hours, weight [of an insoluble solution component] G (g) is measured, and it asks by the following formula (9). It is desirable that the rate of an insoluble solution component is 0 - 10 % of the weight, and it is 0 - 2 % of the weight still more preferably zero to 5% of the weight more preferably. Lower resin has the more desirable rate of an insoluble solution component at the point which is excellent in recycle nature and leads to cost reduction.

[0021]

[Equation 17]

The rate of the insoluble solution component after desiccation (% of the weight)

= $G(g) / [\text{sample weight (g)}] \times 100 \dots (9)$

[0022] In this invention, when it constitutes the base material resin of the above-mentioned foaming sheet from a polypropylene regin, what mixed other resin to the polypropylene regin if needed further can be used. As other resin, for example Ionomer; ethylene-propylene rubber, Rubber, such as a styrene butadiene rubber; A styrene-butylene-styrene block copolymer, A styrene-isoprene-styrene block copolymer, a styrene-butylene-styrene block-copolymer water garnish, A styrene-isoprene-styrene block-copolymer water garnish, ethylene-octene block copolymerization, Thermoplastic elastomer, such as ethylene-butylene block copolymerization; High density polyethylene, Low density polyethylene, straight chain-like low density polyethylene, straight chain-like super-low density polyethylene, Vinyl chloride system resin, such as ethylene system resin; butene system resin; polyvinyl chlorides, such as an ethylene-butene copolymer and an ethylene-maleic-anhydride copolymer, and a vinyl chloride vinyl acetate copolymer; styrene resin etc. is mentioned. When mixing other resin of these, as for the amount of mixing, it is desirable to carry out to 40 or less % of the weight of base material resin AUW.

[0023] When it constitutes the base material resin of the foaming sheet in this invention from polyethylene system resin, moreover, as this polyethylene system resin What the copolymer which consists of the homopolymer of ethylene or ethylene, and an alpha olefin whose carbon number is 3-12 pieces contains 60% of the weight or more in base material resin is mentioned. Specifically High density polyethylene, medium density polyethylene, low density polyethylene, straight chain-like low density polyethylene, What mixed the resin of others, such as propylene system resin and polystyrene system resin, at one sort or two sorts or more of mixture and 40 more or less % of the weight of the rate which are chosen from straight chain-like super-low density polyethylene and an ethylene-vinylacetate copolymer is mentioned.

[0024] As a foaming agent for manufacturing the foaming sheet in this invention, an inorganic system physics foaming agent, an organic system physics foaming agent, a decomposable blowing agent, etc. are used. A carbon dioxide, air, nitrogen, etc. can be used as an inorganic system physics foaming agent. As an organic system physics foaming agent, the ether, such as halogenated hydrocarbon, such as ring type aliphatic hydrocarbon [, such as aliphatic hydrocarbon, such as a propane n-butane i-butane a pentane, and a hexane, a cyclobutane, and a cyclopentane,], 1, 1 and 1, 1-tetrafluoro ethane, 1, and 1-difluoroethane, methyl chloride, ethyl chloride, and a methylene chloride, wood ether, and the methylethyl ether, etc. can be used.

Moreover, as a decomposable blowing agent, an AZOJI carvone amide, dinitrosopentamethylenetetramine, azobisisobutyronitril, sodium bicarbonate, etc. can be used. It can mix suitably and these foaming agents can also be used. In addition, especially in this invention, it is desirable to use a physical foaming agent, when obtaining the foaming sheet of low

[0025] Moreover, the foaming sheet in this invention can add various additives if needed. As an additive, inorganic bulking agents (talc and a silica also have a function as a cellular regulator.), such as cellular regulators, such as a reaction mixture with the acid salt of inorganic powder, such as talc and a silica, or a multiple-valued carboxylic acid, a multiple-valued carboxylic acid and a sodium carbonate, or sodium bicarbonate, talc, a silica, a calcium carbonate, clay, a zeolite, an alumina, and a barium sulfate, a thermostabilizer, an ultraviolet ray absorbent, an antioxidant, a coloring agent, etc. are mentioned. Moreover, an antistatic agent and an antimicrobial agent may be blended.

[0026] 60% or more, as for the rate of a closed cell of the laminating foam in this invention, it is desirable that it is 70% or more, and it is still more desirable that it is especially 80% or more. When the rate of a closed cell becomes lower than 60%, there is a possibility that the rigidity of a foaming sheet and compressive strength may fall, for example, the physical reinforcement of the box which processes laminating foam and is obtained, a container, etc. may fall.

[0027] rate [of the laminating foam in this description] of closed cell: — S (%) — ASTM D — 2856 — 70 — indicating — having — **** — a procedure — C — being based — Toshiba — Beckmann — incorporated company — make — air — relation — an aerometer — 930 — a mold — using it — measuring — having — a laminating — foam — truth — the volume — : — V_x — from — the following — (— ten —) — a formula — computing — having .

[0028]

[Equation 18]

$$S(\%) = (V_x - W/\rho) \times 100 / (V_a - W/\rho) \quad (10)$$

[0029] However, in the above-mentioned (10) formula, V_x is the true volume (cm³) measured by the above-mentioned approach, and is equivalent to the sum of the volume of the resin which constitutes the laminating foam used for measurement, and the product of the closed cell part in the laminating foam used for measurement complete [cellular]. In addition, V_a , W , and ρ in the above-mentioned (10) types are as follows.

[0030] V_a : Apparent volume of the laminating foam calculated from the dimension of the laminating foam used for measurement (cm³)

W : total weight of the laminating foam used for measurement (g)

ρ : consistency of the resin which constitutes laminating foam (g/cm³)

In addition, the consistency ρ of the resin which constitutes laminating foam can perform actuation to which degassing of the air bubbles is carried out from this laminating foam with a heat press, and can ask for a consistency from the obtained sample.

[0031] In addition, since a test piece must be contained in the incompressible condition to the sample cup of attachment in an air relation aerometer, it is cut so that length and width may be set to 2.5cm and height may be set to 4cm, respectively, and the appearance volume makes it the thing of 3 25cm. However, when the thickness of laminating foam does not fulfill 4cm, two or more sheets are used as a test piece combining the test piece for measurement cut from this laminating foam so that 3 might be approached most 25cm.

[0032] As base material resin which constitutes synthetic-resin layers other than the outermost resin layer in this invention The same polypropylene resin and polyethylene system resin as a foaming sheet, others, In that the saponification object of the ethylene-vinyl acetate copolymer which has functionality, such as gas barrier nature, vinylidene chloride resin, polyamide resin, etc. are mentioned, and a foaming sheet, a polyolefine system resin layer, and fitness are pasted especially In order it is desirable to use the thing of the same kind which shows sufficient heat adhesive property as for the resin which constitutes this synthetic-resin layer, an outermost resin layer, and a foaming sheet and to obtain cheap laminating foam As for this synthetic-resin layer, it is more desirable to use what blended the base material resin of a foaming sheet and a recycle raw material of the same kind.

[0033] moreover, as base material resin which constitutes the outermost resin layer which constitutes all the synthetic-resin all [a part or] In that the same polypropylene resin as a foaming sheet and polyethylene system resin are mentioned, and a foaming sheet, or other synthetic-resin layers and fitness are pasted As for the resin which constitutes them, it is

order to obtain cheap laminating foam, as for an outermost resin layer, it is more desirable to use what blended the base material resin of a foaming sheet and a recycle raw material of the same kind.

[0034] Moreover, adding additives, such as an antimicrobial agent and an elastomer, more than a kind to the base material resin which constitutes the synthetic-resin layer containing an outermost resin layer can make the laminating foam of this invention more functional.

[0035] Organic system drugs, such as inorganic system drugs, such as what supported the metal (ion) with antimicrobial activity, such as silver, copper, and zinc, to support as the above-mentioned antimicrobial agent, for example, a silver zeolite, a copper zeolite, a silver support phosphoric-acid zirconium, and silver support silica gel, an antimicrobial agent using the oxide system photocatalyst represented by anatase mold titanium oxide, a benzalkonium chloride, chlorination polyoxyethylene trialkylammonium, a polyhexamethylene biguanide hydrochloride, and chlorination 3-(trimethoxysilyl) propyldimethyloctadecyl ammonium, etc. are mentioned.

[0036] The consistency of the synthetic-resin layer containing the outermost resin layer in this invention is more than 300 (g/L) preferably, and consists of a consistency of base material resin, i.e., non-foaming resin, still more preferably. When the consistency of a synthetic-resin layer is more than 300 (g/L), the object disposition top effectiveness by carrying out the laminating of the synthetic-resin layer, the functional addition effectiveness, the improvement effectiveness in an appearance, etc. can be demonstrated.

[0037] In this description, measurement of the consistency of a synthetic-resin layer and the outermost resin layer in a synthetic-resin layer starts a resin layer to measure a consistency from laminating foam, and is called for by carrying out division process by the volume (L) called for from the dimension of the sample which started the started weight (g) of a sample.

[0038] As for the laminating foam of this invention, the outermost resin layer contains the polymer type antistatic agent (the so-called permanent antistatic agent.), and the surface specific resistance of an outermost resin layer contains the antistatic agent polymer type [this] the 1×10^{13} (Ω/cm) following to the polyolefine system resin which constitutes an outermost resin layer so that it may become below 1×10^{11} (Ω/cm) still more preferably the 1×10^{12} (Ω/cm) following preferably. In addition, although especially the minimum of surface specific resistance is not limited, it is 1×10^8 (Ω/cm) in general.

[0039] It is thought that it does not demonstrate the antistatic effectiveness if it blends with polyolefine system resin simply and the polymer type antistatic agent is not arranged on a resin layer front face where it does not say that the antistatic effectiveness is demonstrated, the antistatic agent distributed in the shape of a muscle on the polyolefine system resin layer front face and a continuation layer is formed (henceforth the network structure).

[0040] This network structure is easy to be formed by applying moderate orientation, in case an outermost resin layer is formed. Therefore, as for an outermost resin layer, from a viewpoint of forming the network structure, it is desirable to form by the extrusion lamination method or the heat lamination method.

[0041] On the other hand, a polymer type antistatic agent is very expensive, and the amount used is restricted in order to manufacture the product of a low price. Therefore, it is enough as a polymer type antistatic agent just to blend only with the outermost resin layer of laminating foam, and, as for this outermost resin layer, it is desirable to make it as thin as possible, to reduce the amount of resin, and to form by less than two two or more basis weight 5 g/m² g/m.

[0042] Thus, it is desirable to adopt a co-extrusion method from a viewpoint of forming the outermost resin layer which made it as thin as possible and reduced the amount of resin.

[0043] When surface specific resistance exceeds 1×10^{13} (Ω/cm), the antistatic effectiveness becomes inadequate, electrostatic charge is accumulated in the front face of laminating foam, and dust adheres.

[0044] Measurement of the surface specific resistance in this description is JIS fundamentally. It shall carry out based on K6911 (1995). Surface resistivity is measured and let the average of the obtained measured value be surface specific resistance, after cutting down three pieces of test

[vertical] to the direction of extrusion of a foaming sheet and specifically leaving a test piece under 23 degrees C and the ambient atmosphere of 50% of humidity from the obtained laminating foam for 24 hours. In addition, the above-mentioned measuring method is JIS. Although the condition was adopted in this description since condition adjustment of a test piece was to be performed based on K6911 (1995) by leaving it under 23 degrees C and the ambient atmosphere of 50% of humidity for 24 hours Since a polymer type antistatic agent is blended in this invention, the surface specific resistance which was not based on the conditions of neglect time amount or humidity, but was stabilized from immediately after laminating foam manufacture is shown. Therefore, even if it leaves the laminating foam of this invention on the above-mentioned conditions for 24 hours and does not carry out it, it demonstrates the outstanding effectiveness it is ineffective to the laminating foam which shows the same surface specific resistance as abbreviation.

[0045] in this description, the surface specific resistance of an outermost resin layer becomes below 1×10^{13} (ohm/cm) — as — **** — a polymer type antistatic agent forms structure like the network structure of fully demonstrating the antistatic engine performance, into the base material resin which constitutes an outermost resin layer structurally, and it means that static electricity can be conducted through this structure. When such structure is not formed, even if the polymer type antistatic agent is blended, it is difficult for surface specific resistance to obtain the outermost resin layer below 1×10^{13} (ohm/cm).

[0046] In this description, as for a polymer type antistatic agent, number average molecular weight shows at least 300–300000, and the thing of the resin with surface specific resistance smaller than 1×10^{12} ohms which is 600–15000 still more preferably preferably 300 or more. Moreover, the polymer type antistatic agent in this description may contain mineral salt or the low-molecular-weight organic proton acid salt 4, for example, LiClO_4 , LiCF_3SO_3 , NaClO_4 , LiBF_4 , NaBF_4 , KBF_4 and KClO_4 , KPF_3SO_3 , calcium $(\text{ClO}_4)_2$ and $\text{Mg}(\text{ClO}_4)_2$, and $\text{Zn}(\text{ClO}_4)_2$ grade. In addition, the upper limit of the number average molecular weight of a polymer type antistatic agent is about 500000.

[0047] the above-mentioned molecular weight is conversion **** number average molecular weight (polystyrene reduced property) using the calibration curve obtained from the polystyrene of molecular-weight known using gel permeation chromatography.

[0048] In this description a polymer type antistatic agent specifically Polyethylene oxide, polypropylene oxide, a polyethylene glycol, A polyether, polyester amide, a polyether ester amide, One sort chosen from quarternary ammonium salt, such as ionomers, such as an ethylene-methacrylic-acid copolymer, and a polyethylene-glycol methacrylate system polymer, Or in a copolymer with two or more sorts of mixture or two or more sorts of copolymers, and the resin of others further, such as them and polypropylene, etc. into a chain, it has a polar group and complexing or the resin which can carry out a solvation mentions mineral salt or a low-molecular-weight organic proton acid salt — having — mineral salt or an organic proton acid salt — complexing — or the solvation has been carried out. In addition, the upper limit of the melting point of a polymer type antistatic agent is 270 degrees C in general, and a minimum is 70 degrees C in general, and are 80–200 still more preferably 80–230 degrees C preferably. It becomes possible to form said good network structure comparatively easily, maintaining the basic physical properties of the base material resin with which an antistatic agent is added when the melting point of an antistatic agent chooses the thing of above-mentioned within the limits. Moreover, as for the crystallization temperature of a polymer type antistatic agent, it is desirable that it is the following ($T_c + 40$ degree C) on the basis of the crystallization temperature (T_c) of the base material resin which constitutes a polyolefine system resin foaming sheet. In addition, the minimum of the crystallization temperature of this antistatic agent is 60 degrees C in general. When the crystallization temperature of an antistatic agent chooses the thing of above-mentioned within the limits, and what was excellent in the antistatic effectiveness is obtained and it obtains the laminating foam of this invention especially by the co-extrusion method, what was excellent especially in the appearance is obtained.

[0049] The measuring method of the melting point of the resin which constitutes an antistatic

calculated by the thermal flux differential scanning calorimetry based on K7121-1987. About the detail of a Measuring condition, it carries out as follows.

Melting point: JIS The test piece which carried out condition adjustment of the test piece according to the conditions (a part for however, cooling rate/of 10 degrees C.) of the conditioning (2) of K7121-1987 and 3. test piece is used, and a fusion peak is acquired by carrying out temperature up in a part for 10-degree-C/. Let temperature of the top-most vertices of the acquired fusion peak be the melting point. In addition, when two or more fusion peaks appear, let temperature of the top-most vertices of a big fusion peak of area be the melting point most. However, when two or more big fusion peaks of area exist most, let the arithmetic mean value of the temperature of the top-most vertices of those fusion peaks be the melting point.

Crystallization temperature: JIS In the conditions of the conditioning (2) of K7121-1987 and 3. test piece, temperature of the top-most vertices of the exothermic peak obtained at the time of cooling rate the temperature fall for /of 10 degrees C is made into crystallization temperature. In addition, when two or more exothermic peaks appear, temperature of the top-most vertices of an exothermic peak with the biggest area is made into crystallization temperature. However, when two or more exothermic peaks with the biggest area exist, the arithmetic mean value of the temperature of the top-most vertices of those exothermic peaks is made into crystallization temperature.

[0050] What uses a polyether ester amide and a polyether as a principal component also especially in the antistatic agent of the polymer type used in this invention is desirable. These antistatic agents can demonstrate the antistatic effectiveness which was excellent, without being greatly influenced by the ratio of the melt flow rate of the base material resin of an outermost resin layer, and the melt flow rate of an antistatic agent. Furthermore, in order to acquire the effectiveness which controls the physical-properties lowering by adding the antistatic effectiveness and the antistatic agent which raised compatibility with the base material resin of an outermost resin layer to these antistatic agents, and were excellent in them, it is desirable to use for a polymer type antistatic agent mixing or the thing which carried out copolymerization for polyolefine system resin and a polyamide of the same kind. In addition, it means containing preferably considering as a principal component in this description at 85% of the weight or more of a rate still more preferably 75% of the weight or more 50% of the weight or more. Surface specific resistance can form easily the outermost resin layer below 1×10^{13} (Ω/cm^2) by forming the network structure etc. by the approach of mentioning later using these antistatic agents.

[0051] The polyether ester amide in this description is obtained by the polymerization reaction with the alkylene oxide addition product (2) of a polyamide (1) and bisphenols illustrated below.

[0052] A polyamide (1) is (a) lactam ring-opening-polymerization object, the polycondensation object of (b) amino carboxylic acid, or (c) dicarboxylic acid and the polycondensation object of diamine. As a lactam of (a), a caprolactam, an ENANTO lactam, a RAURO lactam, an undeca lactam, etc. are mentioned.

[0053] As an amino carboxylic acid of the above (b), omega-aminocaproic acid, omega-amino enanthic acid, omega-amino caprylic acid, omega-amino pel gon acid, omega-amino capric acid, 11-amino undecanoic acid, 12-amino dodecanoic acid, etc. are mentioned.

[0054] As dicarboxylic acid of the above (c), an adipic acid, an azelaic acid, a sebacic acid, a UNDEKANJI acid, a DODEKANJI acid, isophthalic acid, etc. are mentioned, and a hexamethylenediamine, heptamethylene diamine, octamethylene diamine, deca methylene diamine, etc. are mentioned as diamine.

[0055] Two or more kinds of things illustrated as the above-mentioned amide plasticity monomer may be used. A thing desirable [among these] is a caprolactam, 12-amino-dodecanoic-acid, and adipic-acid-hexamethylenediamine, and especially a desirable thing is a caprolactam.

[0056] As bisphenols of the alkylene oxide addition product (2) of said bisphenols, bisphenol A (4 and 4'-dihydroxydiphenyl -2, 2-propane), Bisphenol F (4 and 4'-dihydroxy diphenylmethane), Bisphenol S (4 and 4'-dihydroxy diphenylsulfone), 4, and 4'-dihydroxydiphenyl -2, 2-butane, etc.

[0057] Moreover, as alkylene oxide of the alkylene oxide addition product (2) of said bisphenols, ethyleneoxide, propylene oxide, 1, and 2- or 1, 4-butylene oxide, and two or more kinds of such mixture are mentioned. A thing desirable [among these] is ethyleneoxide.

[0058] As for the melting point of the polyether ester amide which an outermost resin layer contains in this invention, it is desirable that it is 230 degrees C or less, and it is more desirable that it is 200 degrees C or less. Since temperature of both resin must be made high beyond the need in case polyolefine system resin and a polyether ester amide are fused and it mixes if this melting point exceeds 230 degrees C, there is a possibility that polyolefine system resin may deteriorate. Moreover, when carrying out a laminating by the co-extrusion method, although based also on the amount of laminatings of a resin layer, there is a possibility that a foaming sheet may become open cell structure and rigidity may fall.

[0059] When the melting point of a polyether ester amide is 200 degrees C or less, there is almost no possibility that the polyolefine system resin which constitutes an outermost resin layer may deteriorate, and even if it is the case where a laminating is carried out by the co-extrusion method, there is almost no possibility that a foaming sheet may become open cell structure and rigidity may fall.

[0060] The oxy-alkylene ether obtained as a polyether in this description by carrying out the addition reaction of the alkylene oxide to a phenols and a divinylbenzene addition polymer, b) Diglycidyl ether, such as an alkylene oxide addition product of polyoxy ethylene glycol, a polyoxypropylene glycol, a polyoxy butylene glycol, and bisphenols, The amine compound which has the aliphatic hydrocarbon radical of the carbon numbers 1-22 (preferably carbon numbers 6-22), such as hexyl, n-octyl, 2-ethylhexyl, nonyl, DESHIRU, dodecyl, tetradecyl, octadecyl, and oleyl one, Alkyl-sulfuric-acid ester, such as a dimethyl sulfate and a diethyl sulfate; Dimethyl carbonic acid, Alkyl carbonates, such as diethyl carbonic acid; Trimethyl phosphate, Alkyl benzyl chloride, benzyl chloride, alkyl chloride, The cation mold antistatic agent which is a reactant with the 4th class-ized agents, such as various phosphate, such as an alkyl star's picture, or halide, and consists of a compound which has two or more quarternary-ammonium-salt radicals in intramolecular is mentioned.

[0061] As the above-mentioned alkylene oxide, ethyleneoxide, propylene oxide, and butylene oxide are mentioned, and the copolymer of ethyleneoxide and ethyleneoxide, and propylene oxide is [among these] desirable. the number of addition mols of alkylene oxide — usually — 1-500 — it is 20-300 preferably and the oxy-alkylene content in the oxy-alkylene ether is 30 - 80 % of the weight more preferably 20 to 90% of the weight ten to 95% of the weight.

[0062] As the above-mentioned bisphenols, alkylene oxide addition products, such as bisphenol A (4 and 4'-dihydroxydiphenyl -2, 2-propane), Bisphenol F (4 and 4'-dihydroxy diphenylmethane), Bisphenol S (4 and 4'-dihydroxy diphenylsulfone), 4, and 4'-dihydroxydiphenyl -2 and 2-butane, are mentioned.

[0063] Especially a desirable thing is the diglycidyl ether and such mixture of the glycidyl ether of polyoxy ethylene glycol, and the ethylene oxide addition product of bisphenols among the above-mentioned diglycidyl ether.

[0064] Especially a desirable thing is N-alkyl (carbon numbers 1-18) diethanolamine among the above-mentioned amine compounds.

[0065] Especially desirable things are a dimethyl sulfate and a diethyl sulfate among the above-mentioned 4th class-ized agents.

[0066] In order to acquire the effectiveness which controls the physical-properties lowering by adding the antistatic effectiveness and an antistatic agent excellent in the polyether ester amide or polyether mentioned above, it is more desirable that copolymerization of whether a polyamide, and the polyolefine system resin and the polyolefine system resin (number average molecular weight is denaturation polyolefine system resin of 800-25000 especially) of the same kind which constitutes the outermost resin layer are mixed is carried out. As a polyamide used here, the polyamide and copoly amide which were guided from diamine and dicarboxylic acid and/or the amino carboxylic acid, or the corresponding lactam are mentioned. Specifically A polyamide 4, a polyamide 6, polyamides 6/6, 6/10, 6/9, 6/12, 4/6, 12/12, a polyamide 11, a polyamide 12, the

isophthalic acid, and/or a terephthalic acid The polyamide and the above-mentioned polyamide which add an elastomer and are obtained if needed, and polyolefine, An olefin copolymer, an ionomer, or a copolymer with an elastomer, A polyamide or a copoly amide denatured by the block copolymer with a polyamide, a polyethylene glycol, a polypropylene glycol, or a polytetramethylene glycol, EPDM, or ABS is illustrated. The content of these polyolefine system resin and polyamides is 25 or less % of the weight still more preferably 25 or less % of the weight preferably 50 or less % of the weight. The antistatic effectiveness is not lost before and after ultrasonic cleaning according [what added the antistatic agent of the polymer type mentioned above] to the above-mentioned ethanol. Even if it, on the other hand, carries out bleed out of the case of the antistatic agent which consists of surface active agents, such as a mono-glycerol ester system, to a mold-goods front face, it incorporates the moisture in air and it demonstrates the antistatic effectiveness, the antistatic effectiveness will be lost after ultrasonic cleaning by the above-mentioned ethanol. Therefore, ultrasonic cleaning by the above-mentioned ethanol is effective as a means to distinguish the antistatic agent with which the antistatic agent added consists of polymer type an antistatic agent or a surfactant.

[0067] Moreover, the laminating foam of this invention has the operation from which surface specific resistance hardly changes before and after ultrasonic cleaning by ethanol with the value of 1×10^8 to 1×10^{13} (Ω/cm) within the limits by containing an antistatic agent in an outermost resin layer. Such laminating foam can be obtained by making said polymer type of antistatic agent contain as an antistatic agent. In this description, with in addition, ultrasonic cleaning by ethanol The test piece cut down from laminating foam is sunk into 23-degree C ethanol. After ultrasonic cleaning, Point out the actuation dried by leaving this test piece for 36 hours under the ambient atmosphere of the temperature of 30 degrees C, and 30% of relative humidity, and the surface specific resistance after ultrasonic cleaning by ethanol It is JIS except having considered as the test piece which carried out condition adjustment of the test piece immediately after this ultrasonic-cleaning actuation. It is measured based on K6911 (1995). In this invention, the addition of the antistatic agent in an outermost resin layer has 2 - 30 desirable % of the weight, its 5 - 25 % of the weight is more desirable, and its 10 - 20 % of the weight is still more desirable. When an addition is less than 2 % of the weight, and there is a possibility that the antistatic effectiveness may become inadequate and it exceeds 30 % of the weight, while there is a possibility that the formation of physical-properties lowering of an outermost resin layer or an outermost resin layer itself may become difficult, manufacture of cheap laminating foam becomes difficult.

[0068] The laminating foam of this invention consists of synthetic-resin layers which consist of one or more layers by which the laminating is carried out to at least one side of a foaming sheet and this foaming sheet, as mentioned above. It is desirable that this synthetic-resin layer has an outermost resin layer more than consistency 300 (g/L) as an outermost layer of drum. The physical reinforcement of the box which can expect the reinforcement effectiveness by the synthetic-resin layer, processes laminating foam by this, and is obtained, a container, etc. improves, and as a tote box and a housing, it continues and can be used for a long period of time.

[0069] Furthermore, in the laminating foam of this invention, when a synthetic-resin layer consists of a polyolefine system resin layer of a monolayer, it is desirable that melt flow rate: X (g / 10 minutes) of the polyolefine system resin which constitutes this polyolefine system resin layer, basis weight: Y (g/m²) of this polyolefine system resin layer, and consistency: d (g/L) of a foaming sheet satisfy the relation of following the (1) - (4) type.

[0070] The consistency of a foaming sheet: When d, melt flow rate: X of the polyolefine system resin which constitutes this polyolefine system resin layer, and basis weight: Y of this polyolefine system resin layer are not filling the relation of following the (1) - (4) type, while excelling in physical reinforcement, such as rigidity and compressive strength, there is a possibility that surface specific resistance cannot obtain the laminating foam below 1×10^{13} (Ω/cm).

[0071]

[Equation 19] $Y \leq 0.27dX \dots (1)$

computed by $0.27 (m-2 \cdot L \cdot 10 \text{ minutes, } g-1)$, $d (g/L)$, and $X (g / 10 \text{ minutes})$ Under the conditions which can carry out laminating adhesion, the polyolefine system resin layer of basis weight Y and a melt flow rate X on the foaming sheet of a consistency d When the rate of a closed cell of the surface section of the foaming sheet with which the laminating of the polyolefine system resin layer is carried out falls, the physical properties of the laminating foam which the physical properties of a foaming sheet fall, consequently is obtained also fall remarkably. Moreover, the decline in the rate of a closed cell of a foaming sheet causes partial exfoliation of a polyolefine system resin layer. Since the decline in the rate of a closed cell of the above-mentioned foaming sheet has the too large heat capacity of the polyolefine system resin layer of softening in which a laminating is possible on a foaming sheet, or a melting condition, it is considered to be the result by which the cellular structure of a foaming sheet was destroyed with the heat. In addition, as for basis weight: $Y (g/m^2)$ of a polyolefine system resin layer, it is still more desirable that they are 0.23 or less dXs .

[0073]

[Equation 20] $2 \leq X \leq 40 \dots (2)$

[0074] The melt flow rate of the polyolefine system resin which constitutes a polyolefine system resin layer : when X is $2g /$ less than 10 minutes If the resin which constitutes a polyolefine system resin layer to the temperature which shows a good laminating adhesive property is heated when carrying out the laminating of the polyolefine system resin layer to a foaming sheet When there is a possibility that the heat capacity of this resin may become large and the rate of a closed cell of a foaming sheet may fall with the heat and it exceeds $40g / 10 \text{ minutes}$, there is a possibility that appearances, such as surface smooth nature, may become inadequate. in addition, melt flow rate: X of the polyolefine system resin which constitutes a polyolefine system resin layer — desirable — $5-40 (g / 10 \text{ minutes})$ — it is $8-40 (g / 10 \text{ minutes})$ still more preferably.

[0075]

[Equation 21] $5 \leq Y < 80 \dots (3)$

[0076] Basis weight of a polyolefine system resin layer: When Y is less than two $5 g/m$, there is a possibility that formation of the polyolefine system resin layer which can fully demonstrate functions, such as antistatic engine performance and rigidity, may become difficult, and when Y is too large, there is a possibility that the lightweight nature of laminating foam may be lost. in addition, basis weight: Y of a polyolefine system resin layer — desirable — $5-40 (g/m^2)$ — it is $5-30 (g/m^2)$ still more preferably.

[0077]

[Equation 22] $100 \leq d \leq 450 \dots (4)$

[0078] The consistency of a foaming sheet: There is a possibility that physical reinforcement, such as low past rigidity and compressive strength, may be lost for a consistency when d is under $100 (g/L)$, and when exceeding $450 (g/L)$, there is a possibility that the lightweight nature of laminating foam may be lost. In addition, consistency: d of a foaming sheet is $120-300 (g/L)$ preferably.

[0079] The synthetic-resin layer in the laminating foam of this invention by constituting a synthetic-resin layer as a resin layer layered product more than the multilayer synthetic-resin layer which has a polyolefine system resin layer in an outermost layer of drum, i.e., two-layer By making only an outermost resin layer contain at worst functional additives which are excellent in especially physical reinforcement, such as rigidity, such as an effectiveness and polymer type antistatic agent, since the amount of the functional additive used can have the effectiveness of enough functional additives, such as the antistatic effectiveness, at least, it is desirable.

[0080] In the laminating foam to which the laminating of the synthetic-resin layer which consists of a two or more layers polyolefine system resin layer is carried out The basis weight of this synthetic-resin layer is [the basis weight of $80-380 (g/m^2)$, and an outermost resin layer] under $80 (g/m^2)$ more than five (g/m^2) . Consistency: d of a foaming sheet (g/L) , The melt flow rate of the polyolefine system resin which constitutes inner layers other than an outermost resin layer (inner layer which consists of a polyolefine system resin layer more than one layer or two-

minutes), Basis weight of this inner layer: It is desirable that Y' (g/m²) satisfies the relation of following the (5) – (8) type. In addition, there is a possibility that physical reinforcement, such as rigidity, may become inadequate when the basis weight of a synthetic-resin layer is under 80 (g/m²), and on the other hand, when the basis weight of a synthetic-resin layer exceeds 380 (g/m²), there is a possibility that the lightweight nature of laminating foam may be lost. Moreover, when the basis weight of an outermost resin layer is too small, there is possibility that neither the antistatic engine performance nor rigidity can fully be demonstrated. On the other hand, when the basis weight of an outermost resin layer exceeds 80 (g/m²), there is a possibility that the lightweight nature of laminating foam may become inadequate, and the amount of the functional additives used, such as an antistatic agent which adds functionality to laminating foam, will also increase.

[0081]

[Equation 23] $Y' \leq 0.27dX'$ (5)

[0082]

[Equation 24] $5 \leq X' \leq 40$ (6)

[0083]

[Equation 25] $70 \leq Y' \leq 300$ (7)

[0084]

[Equation 26] $100 \leq d \leq 450$ (8)

[0085] When basis weight: Y' of this inner layer is made into less than two 70 g/m as semantics of the above-mentioned (5) – (8) type among the synthetic-resin layers which consist of a two or more layers polyolefine system resin layer, there is a possibility that the object of acquiring sufficient rigidity by carrying out the laminating of the multilayer synthetic-resin layer cannot be attained, and when Y' is too as large as 300 g/m², there is a possibility that the lightweight nature of laminating foam may be lost. Moreover, the melt flow rate of the polyolefine system resin which constitutes this inner layer: When X' is too small, the heat capacity at the time of laminating adhesion on the foaming sheet of a inner layer becomes large, and when there is a possibility that the rate of a closed cell of a foaming sheet may fall and X' exceeds 40 (g / 10 minutes), although based also on the basis weight of an outermost resin layer, there is a possibility that the poor appearance of laminating foam may occur. In addition, the semantics of the above (5) and (8) types is the same as that of the above (1) and (4) types.

[0086] in addition, basis weight: Y' (g/m²) of a inner layer — $0.23dX(s)'$ — it is still more desirable that it is the following. moreover, melt flow rate: X' of a inner layer — desirable — 8–40 (g / 10 minutes) — further — desirable — 10–40 (g / 10 minutes) — it is — basis weight: Y' of a inner layer — desirable — 80–300 (g/m²) — it is 100–250 (g/m²) still more preferably. Moreover, consistency: d of the above-mentioned foaming sheet is 120–300 (g/L) preferably.

[0087] the class of base material resin with which measurement of the melt flow rate of the resin layer in this description constitutes a resin layer — not being concerned — JIS A of K7210 (1999) — based on law, it shall measure by the test temperature of 230 degrees C, and 21.18 Ns of loads In addition, when a synthetic-resin layer contains air bubbles, the melt flow rate of this synthetic-resin layer performs actuation to which degassing of the air bubbles is carried out from this synthetic-resin layer with a heat press, and asks for a melt flow rate from the obtained sample.

[0088] From the photograph which performed ten-point photography at equal intervals under the microscope, and photoed the thickness of the cross section of the cross direction of vertical laminating foam to the direction of extrusion of a foaming sheet, the basis weight of the resin layer in this description measures the thickness of each class, makes the arithmetic mean value of the obtained measured value the thickness of each class, it multiplies by the consistency of the base material resin which constitutes this resin layer in the thickness of a resin layer, and performs unit conversion and is calculated. When the resin layer contains the filler so much with a natural thing, it multiplies by the consistency of a filler content resin layer instead of the consistency of the base material resin of a resin layer, and unit conversion are performed, and the basis weight (g/m²) of a resin layer is calculated.

performed as follows. By the approach beforehand mentioned above, the thickness of laminating foam and the thickness of a synthetic-resin layer are measured, and the basis weight of laminating foam is measured further. Let thickness which reduced the thickness of a synthetic-resin layer be the thickness of a foaming sheet from the thickness of the laminating foam for which it asked.

[0090] Next, the basis weight (g/m²) of a synthetic-resin layer is calculated by said approach. Next, let what reduced the basis weight of a synthetic-resin layer from the basis weight of said foaming layered product be the basis weight of a foaming sheet. The unit conversion of the value which ~~was~~ basis weight (g/m²) of this foaming sheet by the thickness (mm) of the aforementioned foaming sheet are carried out, and it considers as the consistency (g/L) of a foaming sheet.

[0091] In the laminating foam of this invention, when it forms the good network structure that melt flow rate:beta (g / 10 minutes) of the base material resin which an outermost resin layer is made to contain an antistatic agent, and constitutes melt flow rate:alpha (g / 10 minutes) of this antistatic agent and an outermost resin layer has satisfied the relation of following the (9) - (11) type, it is desirable. In addition, since it is difficult to form this network structure compared with other approaches when forming an outermost resin layer by the co-extrusion method, it is effective to satisfy the relation of following the (9) - (11) type especially. Moreover, also when making the synthetic-resin layers and foaming sheets other than an outermost resin layer contain an antistatic agent, as for the relation between melt flow rate:alpha of an antistatic agent, and the melt flow rate of the base material resin which constitutes this synthetic-resin layer and a foaming sheet, it is desirable to have satisfied the relation of following the (9) - (11) type like melt flow rate:beta of the base material resin which constitutes an outermost resin layer.

[0092]

[Equation 27] $10 \leq \alpha \dots (9)$

[0093] The melt flow rate of an antistatic agent: When alpha is under ten (g / 10 minutes), there is a possibility that the viscosity of an antistatic agent may be too high that it stops to form the network structure of an antistatic agent. in addition, melt flow rate:alpha of an antistatic agent — further — it is desirable that it is 10-150 (g / 10 minutes). Even if the value of a melt flow rate alpha is a very big value, since it is usable, this antistatic agent moreover, in the case of an antistatic agent with a big melt flow rate Although it may become difficult for the antistatic agent fused at the time of measurement of this melt flow rate to be discharged from the orifice of a measuring device within an instant, and to measure a melt flow rate to accuracy When an increase and by carrying out and carrying out a quantum from the average consider a measurement count, the upper limit of this melt flow rate:alpha is 500 (g / 10 minutes) in general.

[0094]

[Equation 28] $2 \leq \beta \leq 40 \dots (10)$

[0095] The melt flow rate of the base-material resin which constitutes an outermost resin layer etc.: When there is a possibility that the viscosity of an outermost resin layer may be too high that it stops to form the network structure of an antistatic agent when beta is under two (g / 10 minutes) and it exceeds 40 (g / 10 minutes), there is a possibility that viscosity, such as an outermost resin layer, may be too low that it stops to form the network structure of an antistatic agent. in addition, melt flow rate:beta of the base material resin which constitutes an outermost resin layer etc. — further — it is desirable 3-35 (g / 10 minutes), and that it is especially 8-35 (g / 10 minutes).

[0096]

[Equation 29] $0.5 \leq \alpha/\beta \dots (11)$

[0097] When alpha/beta is less than 0.5, since the viscosity of an antistatic agent is too high, there is a possibility that it may become impossible to form the network structure of an antistatic agent, to the base material resin which constitutes an outermost resin layer etc. On the other hand, when alpha/beta is too large, the viscosity difference of the base material resin

antistatic agent is too large, an antistatic agent condenses, and there is a possibility that it may become impossible to form the network structure of an antistatic agent. Moreover, especially when a polymer type antistatic agent is the thing of an ionomer system, it is desirable to make (alpha/beta) or more into 2.5. in addition, the value of above-mentioned alpha/beta — further — it is desirable 1–250, and that it is especially 1–150. Moreover, when the synthetic-resin layer consists of two or more layers, the melt flow rate of the base material resin which constitutes layers other than an outermost resin layer is desirable when a certain thing prevents the rate lowering of a closed cell of a foaming sheet the melt flow rate of the base material resin which constitutes an outermost resin layer, an EQC, or more than it. measurement of the melt flow rate of the antistatic agent in this description — the class of antistatic agent — not being concerned — JIS A of K7210 (1999) — based on law, it shall measure by the test temperature of 230 degrees C, and 21.18 Ns of loads In addition, in the case of the antistatic agent with which the melting point exceeds 230 degrees C, the relation of the above-mentioned (9) – (11) type is inapplicable.

[0098]

[Example] An example explains this invention still more concretely.

[0099] The resin used for the example and the example of a comparison and an antistatic agent are shown below. In addition, in the following examples and the example of a comparison, a melt flow rate is only expressed as MFR.

[0100] Polypropylene-resin resin I: Grand Polymer company make and trade name J704U (propylene-ethylene block copolymer) (MFR:5g / , 10 minutes)

Resin II: Made in Sun Alomar, the recovery raw material of a trade name SD 632 (propylene system resin) (MFR:10g / , 10 minutes)

Resin III: Made in [Sun Alomar] and trade name PM870A (propylene-ethylene block copolymer) (MFR:17g / , 10 minutes)

Resin IV: Idemitsu Petrochemical company make, trade name J950H.P. (propylene-ethylene block copolymer) (MFR:32g / , 10 minutes)

Resin V: Idemitsu Petrochemical company make, trade name E200GP (propylene homopolymer) (MFR:2g / , 10 minutes)

Resin VI: Made in Sun Alomar, a trade name SD 632 (propylene system resin) (MFR:g [3.2g /], 10 minutes, crystallization temperature: 134 degrees C)

Resin VII: Idemitsu Petrochemical company make, trade name J750H.P. (propylene-ethylene block copolymer) (MFR:14g / , 10 minutes)

[0101] Polymer type antistatic-agent resin A: Product made from tiba SUPESHARUTI KEMIKARUZU, Inc., trade name IRGASTAT P18 (MFR:17g / , 10 minutes, melting-point:180 degree C, crystallization temperature: 143 degrees C) (polyether ester amide + polyamide)

Resin B: Product made from tiba SUPESHARUTI KEMIKARUZU, Inc., trade name IRGASTAT P22 (MFR:21g / , 10 minutes, melting-point:220 degree C, crystallization temperature: 172 degrees C) (polyether ester amide + polyamide)

Resin C: The Sanyo Chemical Industries, Ltd. make, the trade name JIEI stat 3180 (polyether ester amide) (MFR:g [70g /], 10 minutes, melting-point:160 degree C, crystallization temperature: 117 degrees C)

Resin D: Made in [E. I. du Pont de Nemours poly KEMIKARUZU, Inc.] Mitsui, a trade name SD 100 (ethylene system ionomer) (MFR:g [20g /], 10 minutes, melting-point:92 degree C, crystallization temperature: 64 degrees C)

Resin E: The Dai-ichi Kogyo Seiyaku Co., Ltd. make, trade name LEO REXX AS 170 (quarternary-ammonium-salt radical content copolymer) (MFR:100g / 10 minutes or more, the melting point: 80 degrees C)

Resin F: The Sanyo Chemical Industries, Ltd. make, trade name PERESUTATTO 300 (polyether-polypropylene block copolymer) (MFR:100g / 10 minutes or more, melting-point:136 degree C, crystallization temperature: 81 degrees C)

[0102] Surface-active-agent system antistatic agent G: The Riken Vitamin Co., Ltd. make, a trade name S-100 (glycerol monostearate) (melting point: 65 degrees C)

out temperature called for based on K7121-1987. In addition, when two or more peaks appear in a DSC curve, let top-most-vertices temperature of the largest peak of a peak area be the melting point.

[0103] As the extruder for foaming sheet manufacture of examples 1, 2, 4-7, the example 1 of a comparison - 5 laminating foam, The tandem extruder which consists of two sets of extruders, the diameter of 90mm and the diameter of 120mm, is used. Synthetic-resin layers other than an outermost resin layer (it is hereafter called a inner layer.) The extruder with a diameter of 50mm was used as an extruder for formation, and the extruder with a diameter of 40mm was used as an extruder for outermost resin stratification, the laminating was carried out, and in order [of a foaming sheet, a inner layer, and an outermost resin layer] to carry out a co-extrusion, the annular die with a diameter [of 140mm] and a spacing of 1.0mm was used.

[0104] First, in order to form this foaming sheet, the polypropylene resin (resin VI) 100 weight section is received, 0.5 weight section combination of the cellular modifier (melting point: what blended the sodium-citrate 6 weight section to the low-density-polyethylene resin 100 weight section for MFR:5.4g / [109 degrees C and], and 10 minutes) is carried out. This polypropylene resin (resin VI) and a cellular modifier are supplied to the raw material input port of an extruder with a diameter of 90mm. Carry out heating kneading and consider as the melting resin mixture prepared by about 200 degrees C, and the mixed foaming agent which becomes this melting resin mixture from 70 % of the weight of normal butane and 30 % of the weight of isobutanes is pressed fit so that it may become the 1.2 - 2.8 weight section to the resin VI100 weight section. Subsequently, the extruder with a diameter of 120mm connected with the downstream of an extruder with a diameter [said] of 90mm was supplied, and fizz melting resin mixture was obtained.

[0105] The resin shown in the table 2 which constitutes a inner layer on the other hand was supplied to the extruder with a diameter of 50mm, melting kneading was carried out, and melting resin was obtained. Moreover, antistatic melting resin was obtained by carrying out melting kneading of the resin mixture of the resin and the antistatic agent which are shown in the table 2 which constitutes an outermost resin layer from an extruder with a diameter of 40mm. each fizz melting resin mixture, melting resin, and antistatic melting resin which were obtained are supplied into a unification die, and laminating unification of antistatic melting resin, the melting resin which constitutes a inner layer, and the fizz melting resin mixture is carried out — making — the co-extrusion from an annular die, and the outermost resin from an outside — the tubed laminating foam by which the laminating was carried out to the order of a layer / inner layer / foaming sheet / inner layer / outermost resin layer was formed. After clearing a tube-like object, having made the cylinder which had extruded tubed laminating foam cooled meet, and taking over, both sides of the laminating foam were heated and plate-ized with the heating furnace, and target laminating foam was obtained.

[0106] The class of resin which constitutes the inner layer and outermost resin layer of laminating foam in a table 2, MFR and laminating thickness were shown and MFR (X or X') of the polypropylene resin constituent layer which constitutes a resin layer, basis weight (Y or Y') and the thickness (mm) of laminating foam, (%) and the rate of a closed cell, surface specific resistance (ω /**), the surface specific resistance after ultrasonic cleaning (ω /**), and the consistency (g/L) of a foaming sheet were shown in a table 1. In addition, the surface specific resistance just behind extrusion foaming (surface specific resistance measured based on JIS K6911 (1995) except having considered as the test piece which carried out condition adjustment of the laminating foam just behind extrusion foaming (ω /**).) was also combined for reference, and it was shown in a table 2.

[0107] Example 3 inner layer was not prepared but laminating foam was obtained like the example 1 except having used the thing of the class shown in a table 2 as resin which constitutes an outermost resin layer. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0108] Only the foaming sheet was obtained like the example 1 without the example 8 and 9 unification die except it. Subsequently, the laminating of the resin mixture shown in a table 2 as

lamination by the T die, after that, front flesh-side reversal of the foaming sheet with which the laminating of the outermost resin layer was carried out to one side was carried out, and the laminating of the outermost resin layer was similarly carried out to one side of another side in the T die. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0109] Laminating foam was obtained like the example 1 the increase of the addition of ten to example 13 foaming agent, and except having carried out and having made the consistency of a foaming sheet into 130 g/L. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0110] 14 to example 16 inner layer was not prepared, but the thing of the class shown in a table 2 as resin which constitutes an outermost resin layer was used, and laminating foam was obtained like the example 1 except having used the annular dice with a diameter of 98mm. However, plate-ization was not carried out but was rolled round in the shape of a roll as the electrical and electric equipment and a sheet for tray shaping for electronic-parts conveyance. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0111] Laminating foam was obtained like examples 14-16 except having used resin VI / resin VII=30 / 70 (weight ratio) (the crystallization temperature of resin VI / resin VII=30 / 70 (weight ratio) mixing resin having been 133 degrees C in addition.) for the polypropylene resin which constitutes an example 17 foaming sheet. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0112] Examples 1, 2, 4-7, 10-13, and the examples 1-5 of a comparison are laminating foam of five layer systems by which the laminating of a inner layer and the outermost resin layer was carried out to both sides of a foaming sheet, and examples 3, 8, 9, 14-17 are laminating foam of the three-tiered structure by which the laminating only of the outermost resin layer was carried out to both sides of a foaming sheet.

[0113]

[A table 1]

		樹脂口		樹脂発泡体							樹脂方法
		MFR (X又はX') (g/10分)	坪口 (Y又はY') (g/m ²)	発泡シート 密度(d) (g/L)	厚み (mm)	泡立 気泡率 (%)	表面固有抵抗 (Ω/□)	押出発泡直後の 表面固有抵抗 (Ω/□)	超音波洗浄後の 表面固有抵抗 (Ω/□)		
実 例	1	5	175	225	3.1	87	1.5×10 ¹⁰	2.4×10 ¹²	2.8×10 ¹²	共押出(両面)	
	2	10	135	130	4.0	85	6.6×10 ¹⁰	7.5×10 ¹⁰	7.0×10 ¹⁰	同上	
	3	12	37	112	4.0	83	2.3×10 ¹¹	1.7×10 ¹¹	1.7×10 ¹¹	同上	
	4	17	135	130	4.0	87	5.8×10 ¹¹	6.0×10 ¹¹	7.0×10 ¹¹	同上	
	5	10	同上	130	4.0	73	3.2×10 ¹²	3.5×10 ¹²	3.2×10 ¹²	同上	
	6	10	同上	130	4.0	83	4.3×10 ¹⁰	6.6×10 ¹⁰	6.0×10 ¹⁰	同上	
	7	32	同上	130	4.0	87	6.2×10 ¹²	7.4×10 ¹²	8.2×10 ¹²	同上	
	8	3	60	150	2.0	85	3.0×10 ¹³	2.0×10 ¹³	1.8×10 ¹³	押出ラミ(両面)	
	9	同上	同上	150	2.0	85	6.6×10 ¹²	6.6×10 ¹²	6.0×10 ¹²	同上	
	10	5	175	130	5.0	80	1.5×10 ¹²	2.1×10 ¹²	2.5×10 ¹²	共押出(両面)	
	11	5	135	同上	4.0	82	9.5×10 ¹⁰	9.0×10 ¹⁰	9.0×10 ¹⁰	同上	
	12	10	同上	同上	同上	85	8.7×10 ¹⁰	8.0×10 ¹⁰	7.6×10 ¹⁰	同上	
	13	17	同上	同上	同上	87	4.4×10 ¹⁰	4.0×10 ¹⁰	5.1×10 ¹⁰	同上	
	14	14	7	280	1.5	92	6.0×10 ¹¹	4.2×10 ¹¹	4.8×10 ¹¹	同上	
	15	14	13	275	1.2	94	4.5×10 ¹¹	5.2×10 ¹¹	4.5×10 ¹⁰	同上	
	16	14	25	280	2.0	90	8.5×10 ¹⁰	9.8×10 ¹⁰	1.2×10 ¹¹	同上	
	17	14	13	275	1.2	98	4.2×10 ¹¹	6.1×10 ¹¹	5.9×10 ¹¹	同上	
比 較 例	1	10	135	130	4.0	85	2.8×10 ¹⁰	5.0×10 ¹⁰	5.3×10 ¹⁰	共押出(両面)	
	2	10	135	130	4.0	84	4.3×10 ¹⁰	5.0×10 ¹⁰	4.5×10 ¹⁰	同上	
	3	32	同上	130	4.0	84	6.0×10 ¹⁰	6.6×10 ¹⁰	6.8×10 ¹⁰	同上	
	4	10	同上	130	4.0	85	4.5×10 ¹⁰	4.1×10 ¹⁰	4.5×10 ¹⁰	同上	
	5	10	同上	130	4.0	85	5.0×10 ¹⁰	4.2×10 ¹⁰	6.2×10 ¹⁰	同上	

[0114]

[A table 2]

		最外樹脂層以外の合成樹脂層 (内層)			最外樹脂層			積層発泡体各層の坪量 (最外樹脂層/内層/発泡シート/ 内層/最外樹脂層) (g/m ²)	
		種類	MFR (g/10分)	被膜厚み (μm)	種類	帯電防止剤 添加量 (重量%)	MFR α/β (g/10分)		被膜厚み (μm)
実施例	1	樹脂Ⅰ	5	194	樹脂A/樹脂Ⅰ	15	17/5	28	25/175/600/175/25
	2	樹脂Ⅱ*	10	150	樹脂A/樹脂Ⅱ	同上	17/10	同上	25/135/480/135/25
	3	—	—	—	同上	同上	同上	40	870/440/0/37
	4	樹脂Ⅱ	17	150	樹脂A/樹脂Ⅲ	同上	17/17	28	25/135/480/135/25
	5	樹脂Ⅱ*	10	同上	樹脂B/樹脂Ⅱ*	15	21/10	同上	同上
	6	樹脂Ⅱ*	同上	同上	樹脂C/樹脂Ⅱ	20	70/10	同上	同上
	7	樹脂Ⅳ	32	同上	樹脂C/樹脂Ⅳ	同上	70/32	同上	同上
	8	—	—	—	樹脂A/樹脂Ⅴ	15	17/2	55	50/0/280/0/50
	9	—	—	—	樹脂D/樹脂Ⅴ	20	20/2	同上	同上
	10	樹脂Ⅰ	5	194	樹脂A/樹脂Ⅰ	15	17/5	28	25/175/600/175/25
	11	樹脂Ⅰ*	5	150	樹脂F/樹脂Ⅰ	同上	100以上/5	同上	25/135/480/135/25
	12	樹脂Ⅱ*	10	同上	樹脂F/樹脂Ⅱ	同上	100以上/10	同上	同上
	13	樹脂Ⅲ*	17	同上	樹脂F/樹脂Ⅲ	同上	100以上/17	同上	同上
	14	—	—	—	樹脂F/樹脂Ⅶ	30	100以上/14	8	7/0/436/0/7
	15	—	—	—	樹脂F/樹脂Ⅶ	20	100以上/14	15	13/0/324/0/13
	16	—	—	—	樹脂F/樹脂Ⅶ	20	100以上/14	28	25/0/550/0/25
	17	—	—	—	樹脂F/樹脂Ⅶ	20	100以上/14	15	13/0/324/0/13
比較例	1	樹脂Ⅱ*	10	150	樹脂A/樹脂Ⅱ	1	17/10	28	25/135/480/135/25
	2	樹脂Ⅱ	10	150	樹脂D/樹脂Ⅱ	20	20/10	同上	25/135/480/135/25
	3	樹脂Ⅳ	32	同上	樹脂D/樹脂Ⅳ	同上	20/32	同上	同上
	4	樹脂Ⅱ	10	同上	樹脂E/樹脂Ⅱ	15	100以上/10	同上	同上
	5	樹脂Ⅱ*	同上	同上	G/樹脂Ⅱ*	0.8	—/10	同上	同上

*：熱可塑性エラストマー（エチレン-オクテンランダム共重合体、MFR=10.6g/10分）『ダウケミカル社製、商品名：アフィニティーEG8200』を更に2.5重量%添加

[0115] It is shown on a chart by making a table 3 the consistency of a foaming sheet, the melt flow rate of a resin layer, the basis weight of a resin layer, and the numeric value of 0.27dX(s)' in the numeric value of dX(s) or the 0.27 aforementioned (5) type in the aforementioned (1) formula.

[0116]

[A table 3]

		MFR (X又はX') (g/10分)		発泡シート 密度(d) (g/L)	0.27dX 又は 0.27dX'	樹脂層の厚さ (Y又はY') (g/m ²)	
		X	X'			Y	Y'
実施例	1	—	5	225	304	—	175
	2	—	10	130	351	—	135
	3	12	—	112	363	37	—
	4	—	17	130	597	—	135
	5	—	10	130	351	—	135
	6	—	10	130	351	—	135
	7	—	32	130	1123	—	135
	8	3	—	150	122	50	—
	9	3	—	150	122	50	—
	10	—	5	130	176	—	175
	11	—	5	130	176	—	135
	12	—	10	130	351	—	135
	13	—	17	130	597	—	135
	14	14	—	290	1096	7	—
	15	14	—	275	1040	13	—
	16	14	—	280	1058	25	—
	17	14	—	275	1040	13	—
比較例	1	—	10	130	351	—	135
	2	—	10	130	351	—	135
	3	—	32	130	1123	—	135
	4	—	12	130	351	—	135

[0117]

[Effect of the Invention] As explained above, the polyolefine system resin laminating foam of this invention is a thing of one or more layers in which this synthetic-resin layer has a polyolefine system resin layer more than consistency 300 (g/L) as an outermost layer of drum in the laminating foam from which the laminating of the synthetic-resin layer more than consistency 300 (g/L) is carried out, and it becomes at least one side of a polyolefine system resin foaming sheet. Since the polymer type antistatic agent contains so that surface specific resistance may become this polyolefine system resin layer below 1×10^{13} (Ω/cm^2), sufficient antistatic effectiveness is discovered from immediately after shaping, the antistatic effectiveness is not spoiled by washing, and it can be used suitable for a returnable application.

[0118] A synthetic-resin layer consists of a polyolefine system resin layer of a monolayer, and the polyolefine system resin laminating foam of this invention is the consistency of this polyolefine system resin foaming sheet, The melt flow rate of the polyolefine system resin which constitutes the polyolefine system resin layer of this monolayer, When the basis weight of the polyolefine system resin layer of this monolayer satisfies specific relation, while becoming what a good foaming layer is formed and is excellent in physical reinforcement, such as rigidity and compressive strength, without the rate of a closed cell of a foaming sheet falling The polyolefine system resin laminating foam of cheap this invention which added functionality, such as antistatic engine performance and antibacterial ability, can be offered by adding a functional additive in small quantity and a polyolefine system resin layer. Moreover, it consists of a polyolefine system resin layer which the basis weight of a synthetic-resin layer is 80–380 (g/m²), and are. The basis weight of the polyolefine system resin layer which constitutes the outermost layer of drum among the polyolefine system resin layers of these two or more layers is under 80 (g/m²) more than five (g/m²). The consistency of this polyolefine system resin foaming sheet, The melt flow rate of the polyolefine system resin which constitutes the inner layer which consists of resin layers other than this outermost layer of drum among the polyolefine system resin layers of these two or more layers, When the basis weight of this inner layer satisfies specific relation, while being able to form the synthetic-resin layer which has sufficient thickness and excelling especially in physical reinforcement. such as flexural strength. without reducing the

rate of a closed cell of a foaming sheet. The polyolefine system resin laminating foam of cheap this invention which added functionality, such as antistatic engine performance and antibacterial ability, can be offered by adding a functional additive in small quantity and a polyolefine system resin layer.

[0119] In this invention, if a polypropylene resin is used as the base material resin of a polyolefine system resin foaming sheet, and base material resin of a polyolefine system resin layer, the polyolefine system resin laminating foam which is excellent in physical reinforcement and thermal resistance, such as rigidity, can be offered.

[0120] In this invention, when surface specific resistance can form easily the polyolefine system resin layer below 1×10^{13} (Ω/cm^2) if what uses a polyether ester amide and a polyether as a principal component as a polymer type antistatic agent is used, and the base material resin of a polyolefine system resin layer is a polypropylene resin especially, if the principal component of a polymer type antistatic agent uses the copolymer of a polyether and polypropylene, or the mixture of a polyether and polypropylene, it can form still more easily.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the shape of a sheet and tabular polyolefine system resin laminating foam used for the diaphragm of various containers, a core material and a tote box, a housing, the electrical and electric equipment, an electronic-parts conveyance tray, etc.

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PRIOR ART

[Description of the Prior Art] Conventionally, sheet-like polyolefine system resin foam has been widely used for various kinds of containers and tote boxes, such as a food-grade tray, a lunch box, a bowl, and a cup, a housing, etc. However, since polyolefine system resin foam has a fault of dirt or a cone that dust tends to adhere since static electricity tends to be charged, giving the antistatic effectiveness has been performed by adding the surfactant of low molecular weight, such as a mono-glycerol ester system.

[0003] However, if bleed out of the surface active agent of low molecular weight, such as a mono-glycerol ester system, is not carried out to a mold-goods front face, it does not demonstrate the antistatic effectiveness. Therefore, since the surfactant of low molecular weight is usually needed one week or more until the antistatic effectiveness made into the object is discovered, the polyolefine system resin foam by which this surfactant was added needs a large warehouse tooth space, and has the problem that makeshift of a delivery date is difficult.

[0004] Moreover, since said surfactant does not discover the antistatic effectiveness if it does not incorporate the moisture in air, a season and the environmental influence used are received greatly and it also has the problem that the antistatic effectiveness made into the object as a result may not be discovered.

[0005] Furthermore, with water, a detergent, etc., since a surfactant will be washed out if it washes, by the time the foam by which said surfactant was added demonstrates the antistatic effectiveness again, it will need time amount. Therefore, since it is difficult for the tote box which used the foam by which such a surfactant was added to wash and carry out a reuse, in the application which dislikes static electricity and dust, the returnable activity is difficult.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, the polyolefine system resin laminating foam of this invention is a thing of one or more layers in which this synthetic-resin layer has a polyolefine system resin layer more than consistency 300 (g/L) as an outermost layer of drum in the laminating foam from which the laminating of the synthetic-resin layer more than consistency 300 (g/L) is carried out, and it becomes at least one side of a polyolefine system resin foaming sheet. Since the polymer type antistatic agent contains so that surface specific resistance may become this polyolefine system resin layer below 1×10^{13} (Ω/cm), sufficient antistatic effectiveness is discovered from immediately after shaping, the antistatic effectiveness is not spoiled by washing, and it can be used suitable for a returnable application.

[0118] A synthetic-resin layer consists of a polyolefine system resin layer of a monolayer, and the polyolefine system resin laminating foam of this invention is the consistency of this polyolefine system resin foaming sheet, The melt flow rate of the polyolefine system resin which constitutes the polyolefine system resin layer of this monolayer, When the basis weight of the polyolefine system resin layer of this monolayer satisfies specific relation, while becoming what a good foaming layer is formed and is excellent in physical reinforcement, such as rigidity and compressive strength, without the rate of a closed cell of a foaming sheet falling The polyolefine system resin laminating foam of cheap this invention which added functionality, such as antistatic engine performance and antibacterial ability, can be offered by adding a functional additive in small quantity and a polyolefine system resin layer. Moreover, it consists of a polyolefine system resin layer which the basis weight of a synthetic-resin layer is 80–380 (g/m²), and are. The basis weight of the polyolefine system resin layer which constitutes the outermost layer of drum among the polyolefine system resin layers of these two or more layers is under 80 (g/m²) more than five (g/m²). The consistency of this polyolefine system resin foaming sheet, The melt flow rate of the polyolefine system resin which constitutes the inner layer which consists of resin layers other than this outermost layer of drum among the polyolefine system resin layers of these two or more layers, When the basis weight of this inner layer satisfies specific relation, while being able to form the synthetic-resin layer which has sufficient thickness and excelling especially in physical reinforcement, such as flexural strength, without reducing the rate of a closed cell of a foaming sheet The polyolefine system resin laminating foam of cheap this invention which added functionality, such as antistatic engine performance and antibacterial ability, can be offered by adding a functional additive in small quantity and a polyolefine system resin layer.

[0119] In this invention, if a polypropylene resin is used as the base material resin of a polyolefine system resin foaming sheet, and base material resin of a polyolefine system resin layer, the polyolefine system resin laminating foam which is excellent in physical reinforcement and thermal resistance, such as rigidity, can be offered.

[0120] In this invention, when surface specific resistance can form easily the polyolefine system resin layer below 1×10^{13} (Ω/cm) if what uses a polyether ester amide and a polyether as a principal component as a polymer type antistatic agent is used, and the base material resin of a polyolefine system resin layer is a polypropylene resin especially, if the principal component of a polymer type antistatic agent uses the copolymer of a polyether and polypropylene. or the

mixture of a polyether and polypropylene, it can form still more easily.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention aims at offer of the laminating polyolefine system resin foam which has sufficient antistatic effectiveness from immediately after shaping, and the antistatic effectiveness is not spoiled by washing and has usable laminating polyolefine system resin foam and sufficient reinforcement for a returnable application.

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MEANS

[Means for Solving the Problem] Namely, this invention is set to the laminating foam which comes to carry out the laminating of the synthetic-resin layer to at least one side of (1) polyolefine system resin foaming sheet. This synthetic-resin layer is the thing of one or more layers which has a polyolefine system resin layer in an outermost layer of drum. The polyolefine system resin laminating foam characterized by the polymer type antistatic agent containing so that surface specific resistance may become this polyolefine system resin layer below 1×10^{13} (Ω/cm), (2) In the laminating foam which comes to carry out the laminating of the synthetic-resin layer to at least one side of a polyolefine system resin foaming sheet This synthetic-resin layer is the thing of one or more layers which has a polyolefine system resin layer in an outermost layer of drum. In this polyolefine system resin layer The polyolefine system resin laminating foam characterized by the antistatic agent containing so that the surface specific resistance after ultrasonic cleaning by ethanol may be set to 1×10^8 to 1×10^{13} (Ω/cm), (3) A synthetic-resin layer consists of a polyolefine system resin layer of a monolayer. Consistency: d of this polyolefine system resin foaming sheet (g/L), The melt flow rate of the polyolefine system resin which constitutes the polyolefine system resin layer of this monolayer : X (g / 10 minutes), Basis weight of the polyolefine system resin layer of this monolayer: The above (1) with which Y (g/m²) is characterized by satisfying the relation of following the (1) - (4) type, or polyolefine system resin laminating foam given in (2) [Equation 9] $Y \leq 0.27dX$ (1)

[Equation 10] $2 \leq X \leq 40$ (2)

[Equation 11] $5 \leq Y \leq 80$ (3)

[Equation 12] $100 \leq d \leq 450$ (4)

(4) It consists of a polyolefine system resin layer which the basis weight of a synthetic-resin layer is 80-380 (g/m²), and are. The basis weight of the polyolefine system resin layer which constitutes the outermost layer of drum among the polyolefine system resin layers of these two or more layers is under 80 (g/m²) more than five (g/m²). Consistency: d of this polyolefine system resin foaming sheet (g/L), The melt flow rate of the polyolefine system resin which constitutes the inner layer which consists of resin layers other than this outermost layer of drum among the polyolefine system resin layers of these two or more layers : X' (g / 10 minutes), Basis weight of this inner layer: The above (1) with which Y' (g/m²) is characterized by satisfying the relation of following the (5) - (8) type, or polyolefine system resin laminating foam given in (2)

[Equation 13] $Y' \leq 0.27dX'$ (5)

[Equation 14] $5 \leq X' \leq 40$ (6)

[Equation 15] $70 \leq Y' \leq 300$ (7)

[Equation 16] $100 \leq d \leq 450$ (8)

(5) Polyolefine system resin laminating foam given in either of aforementioned (1) - (4) characterized by the base material resin which constitutes a polyolefine system resin foaming sheet being a polypropylene resin, (6) Polyolefine system resin laminating foam given in either of aforementioned (1) - (5) characterized by the base material resin which constitutes a polyolefine system resin layer being a polypropylene resin, (7) It is based on the crystallization temperature (T_c) of the base material resin which constitutes a polyolefine system resin foaming sheet by the crystallization temperature of an antistatic agent. Polyolefine system resin laminating foam given

in either of aforementioned (1) – (6) characterized by being the following, (Tc+40 degree C) (8) Polyolefine system resin laminating foam given in either of aforementioned (1) – (7) characterized by the principal component of an antistatic agent being a polyether ester amide, (9) Polyolefine system resin laminating foam given in either of aforementioned (1) – (7) characterized by the principal component of an antistatic agent being a polyether, (10) The principal component of an antistatic agent The copolymer of a polyether and polypropylene, Or polyolefine system resin laminating foam given in either of aforementioned (1) – (7) characterized by being the mixture of a polyether and polypropylene, (11) Polyolefine system resin laminating foam with an antistatic agent given in either of 2 – aforementioned [which are characterized by containing 30% of the weight] (1) – (10), (12) Polyolefine system resin laminating foam given in either of aforementioned (1) – (11) characterized by the polyolefine system resin layer which constitutes the outermost layer of drum containing the antimicrobial agent, (13) Polyolefine system resin laminating foam with the thickness of the whole laminating foam given in either of 0.5 – aforementioned [which are characterized by being 10mm and the rate of a closed cell of laminating foam being 60% or more] (1) – (12), (14) Polyolefine system resin laminating foam given in either of aforementioned (1) – (13) characterized by obtaining laminating foam by the co-extrusion method. (15) an antistatic agent — containing — polyolefine — a system — resin — a layer — constituting — **** — an antistatic agent — a melt flow rate — alpha (g / 10 minutes) — polyolefine — a system — resin — a melt flow rate — beta — a ratio (alpha/beta) — 0.5 — more than — it is — things — the description — ** — carrying out — the above — (— one —) — (— 14 —) — either — a publication — polyolefine — a system — resin — a laminating — foam — a summary — carrying out .

[0008]

[Embodiment of the Invention] As for the polyolefine system resin laminating foam (only henceforth laminating foam) of this invention, the laminating of a monolayer or the two or more layers synthetic-resin layer is carried out to one side or both sides of a polyolefine system resin foaming sheet (only henceforth a foaming sheet). And the consistency of this synthetic-resin layer may be the thing of more than 300 (g/L), i.e., low foaming, or may contain the filler so much. Furthermore, it has the polyolefine system resin layer as an outermost layer of drum of this synthetic-resin layer. That is, the laminating foam of this invention has a polyolefine system resin layer (only henceforth an outermost resin layer) in the outermost layer of drum of one side or both sides.

[0009] Therefore, that to which the laminating of that by which that by which the laminating of the outermost resin layer was carried out to one side of a foaming sheet was mentioned as lamination with the easiest laminating foam of this invention, in addition the laminating of the outermost resin layer was carried out to both sides of a foaming sheet, and the synthetic-resin layer which becomes each of both sides of a foaming sheet from more than two-layer [of an outermost resin layer and other resin layers] was carried out is mentioned. in addition, the case where a synthetic-resin layer consists of a two or more layers polyolefine system resin layer in this description — resin layers other than an outermost resin layer, i.e., a inner layer, — from the polyolefine system resin layer more than one layer or two-layer — since — it is constituted. The laminating foam of this invention has such structure, and can turn into a layered product which has the broad physical properties according to the application of laminating foam by defining suitably combination with the class of synthetic-resin layers other than the class of foaming sheet, a consistency, the class of outermost resin layer and basis weight, and an outermost resin layer, basis weight, and a melt flow rate especially.

[0010] As for the laminating foam of this invention, it is desirable that the whole thickness is 0.5–10mm, and it is more desirable that it is 1–8mm. When the whole thickness is less than 0.5mm, wall thickness which processed laminating foam, for example and was obtained depending on the application, such as a box and a container, becomes inadequate, and there is a possibility that reinforcement, adiathermic, buffer nature, etc. may fall. On the other hand, when the whole thickness exceeds 8mm, there is a possibility that the fabricating-operation nature to bending nature, such as a hinge, a box, a container, etc. may fall.

thickness of the cross section of the vertical cross direction at equal intervals under the microscope, and subsequently photoed ten-point photography, the thickness of the laminating foam in this description measures the thickness of laminating foam, and makes the arithmetic mean value of each measured value the thickness of laminating foam.

[0012] The foaming sheet which constitutes the laminating foam of this invention can be manufactured by the extrusion-foaming method, and can also manufacture a synthetic-resin layer with extrusion. As an approach of carrying out the laminating of the synthetic-resin layer to a foaming sheet in this invention, the co-extrusion method extruded after carrying out the laminating of the foaming sheet and the synthetic-resin layer which were formed using the approach of carrying out extrusion lamination of the synthetic-resin layer to the foaming sheet manufactured separately, the approach of carrying out heat lamination of the film (synthetic-resin layer) manufactured at another process on the foaming sheet, and a different extruder within a die is mentioned.

[0013] In these approaches, a co-extrusion method with easy forming a thinner outermost resin layer is desirable from a viewpoint that laminating foam cheap when mixing expensive additives, such as a polymer type antistatic agent and an antimicrobial agent, in an outermost resin layer can be obtained. Moreover, the antistatic agent of the polymer type used in this invention can make the original antistatic effectiveness of a polymer type antistatic agent discover by arranging, where it distributed on the polyolefine system resin layer front face in the shape of a muscle and a continuation layer is formed in it. And the approach of carrying out the heat lamination of the film which manufactured at the extrusion lamination method which can form the continuation layer of the antistatic agent which distributed in the shape of a muscle comparatively easily from the reason for being easy to form the antistatic-agent content resin layer to which orientation of the constraint on the temperature of melting resin was carried out small and moderately at the time of melting kneading of an antistatic agent or the laminating to the foaming sheet of an antistatic-agent content resin layer compared with a co-extrusion method, or another process is also employable.

[0014] Manufacture by the extrusion-foaming method of the foaming sheet in this invention is explained in full detail. This foaming sheet can be obtained by extruding and foaming to the bottom of low voltage through the die which attached this melting kneading object at the head of an extruder, after kneading with a foaming agent, while carrying out melting of the base material resin within an extruder. In order to form as sheet-like foam, the approach of carrying out [the approach] extrusion foaming, and obtaining tube-like foam, clearing this tube subsequently, and making it into the shape of a sheet from the lip of this die, is preferably adopted using the circular die which has an annular lip. In addition, it is also possible to manufacture by the approach of replacing with a circular die and extruding from flat dies, such as a T die.

[0015] The base material resin which constitutes the foaming sheet of this invention is polyolefine system resin, and a polypropylene resin, polyethylene system resin, etc. are mentioned as this polyolefine system resin. Polyolefine system resin is rich in flexibility, and it excels in physical reinforcement, such as tensile strength, and has chemical resistance, and it is that of extrusion-foaming nature proper *****, and is the raw material which was excellent as base material resin which constitutes the foaming sheet of this invention, and the polypropylene resin which is excellent in rigidity or thermal resistance also in polyolefine system resin is preferably used especially in this invention.

[0016] As the above-mentioned polypropylene resin, a propylene homopolymer or the copolymer of a propylene and other olefins which can be copolymerized is mentioned. As other copolymerization components in which a propylene and copolymerization are possible, the alpha olefin of ethylene or carbon numbers 4-10, such as ethylene, 1-butene, an isobutylene, 1-pentene, a 3-methyl-1-butene, 1-hexene, 3, a 4-dimethyl-1-butene, 1-heptene, and a 3-methyl-1-hexene, is illustrated, for example. moreover — even if the above-mentioned copolymer is a random copolymer — a block copolymer — you may be — further — again — duality — you may be not only a copolymer but a ternary polymerization object. Moreover, these polypropylene resins are independent, or two or more sorts can be mixed and used for them.

foaming sheet, it is desirable that the copolymerization component contains 25 or less % of the weight in a copolymer especially at 15 or less % of the weight of a rate. Moreover, the lower limit with the desirable copolymerization component contained in a copolymer is 0.3 % of the weight. [0018] That in which melting tension contains a high polypropylene resin as suitable resin for extrusion foaming also in the above-mentioned polypropylene resin as compared with a general polypropylene resin is desirable, and the polypropylene resin which contains a polypropylene resin with this high melting tension 15 to 50% of the weight especially is desirable from having the manufacturing cost, the recycle nature, and extrusion-foaming **** of this invention laminating foam. With in addition, a polypropylene resin with this high melting tension As [indicate / for example, / by the patent registration No. 2521388 and JP,7-53797,A] (1) The polypropylene which has less than one branching characteristic and remarkable strain-hardening elongation viscosity, (2) [whether (a) Z average molecular weight (M_z) is 1.0×10^6 or more and] Or the ratio (M_z/M_w) of Z average molecular weight (M_z) and weight average molecular weight (M_w) is 3.0 or more. (b) And [whether the balanced compliance J_0 is more than $1.2 \times 10^{-3} \text{ m}^2/\text{N}$ and] Or the thing whose shearing distortion recovery S_r/S per unit stress is more than per second $5 \text{ m}^2/\text{N}$, (3) the compound containing a radical polymerization nature monomer, radical polymerization initiators, additives, such as styrene, etc. The polypropylene resin by which refining was carried out by a polypropylene resin's fusing and carrying out melting kneading more than the reaction temperature of a radical polymerization initiator, Or the refining polypropylene resin obtained by carrying out melting kneading of (4) polypropylene resins, an isoprene monomer, and the radical polymerization initiator is mentioned.

[0019] Moreover, what has the rate of an insoluble solution component to an ebullition xylene that it is low also in a polypropylene resin with the above-mentioned high melting tension is desirable.

[0020] The rate of the above-mentioned insoluble solution component makes a sample the polypropylene resin which weighed weight precisely, or its foaming sheet. After paying a sample into about 145-degree C xylene and carrying out heating reflux for 8 hours, it filters promptly at the wire gauze of 100 meshes. Subsequently, after drying the ebullition xylene insoluble solution component which remained on the wire gauze in 20-degree C oven for 24 hours, weight [of an insoluble solution component] G (g) is measured, and it asks by the following formula (9). It is desirable that the rate of an insoluble solution component is 0 - 10 % of the weight, and it is 0 - 2 % of the weight still more preferably zero to 5% of the weight more preferably. Lower resin has the more desirable rate of an insoluble solution component at the point which is excellent in recycle nature and leads to cost reduction.

[0021]

[Equation 17]

The rate of the insoluble solution component after desiccation (% of the weight)

$$= G(g) / [\text{sample weight (g)}] \times 100 \dots (9)$$

[0022] In this invention, when it constitutes the base material resin of the above-mentioned foaming sheet from a polypropylene resin, what mixed other resin to the polypropylene resin if needed further can be used. As other resin, for example Ionomer; ethylene-propylene rubber, Rubber, such as a styrene butadiene rubber; A styrene-butylene-styrene block copolymer, A styrene-isoprene-styrene block copolymer, a styrene-butylene-styrene block-copolymer water garnish, A styrene-isoprene-styrene block-copolymer water garnish, ethylene-octene block copolymerization, Thermoplastic elastomer, such as ethylene-butylene block copolymerization; High density polyethylene, Low density polyethylene, straight chain-like low density polyethylene, straight chain-like super-low density polyethylene, Vinyl chloride system resin, such as ethylene system resin; butene system resin; polyvinyl chlorides, such as an ethylene-butene copolymer and an ethylene-maleic-anhydride copolymer, and a vinyl chloride vinyl acetate copolymer; styrene resin etc. is mentioned. When mixing other resin of these, as for the amount of mixing, it is desirable to carry out to 40 or less % of the weight of base material resin AUW.

[0023] When it constitutes the base material resin of the foaming sheet in this invention from polyethylene system resin, moreover, as this polyethylene system resin What the copolymer

number is 3-12 pieces contains 60% of the weight or more in base material resin is mentioned. Specifically High density polyethylene, medium density polyethylene, low density polyethylene, straight chain-like low density polyethylene, What mixed the resin of others, such as propylene system resin and polystyrene system resin, at one sort or two sorts or more of mixture and 40 more or less % of the weight of the rate which are chosen from straight chain-like super-low density polyethylene and an ethylene-vinylacetate copolymer is mentioned.

[0024] As a foaming agent for manufacturing the foaming sheet in this invention, an inorganic system physics foaming agent, an organic system physics foaming agent, a decomposable blowing agent, etc. are used. A carbon dioxide, air, nitrogen, etc. can be used as an inorganic system physics foaming agent. As an organic system physics foaming agent, the ether, such as halogenated hydrocarbon, such as ring type aliphatic hydrocarbon [, such as aliphatic hydrocarbon, such as a propane n-butane i-butane a pentane, and a hexane, a cyclobutane, and a cyclopentane,], 1, 1 and 1, 1-tetrafluoro ethane, 1, and 1-difluoroethane, methyl chloride, ethyl chloride, and a methylene chloride, wood ether, and the methylethyl ether, etc. can be used. Moreover, as a decomposable blowing agent, an AZOJI carvone amide, dinitrosopentamethylenetetramine, azobisisobutyronitril, sodium bicarbonate, etc. can be used. It can mix suitably and these foaming agents can also be used. In addition, especially in this invention, it is desirable to use a physical foaming agent, when obtaining the foaming sheet of low basis weight.

[0025] Moreover, the foaming sheet in this invention can add various additives if needed. As an additive, inorganic bulking agents (talc and a silica also have a function as a cellular regulator.), such as cellular regulators, such as a reaction mixture with the acid salt of inorganic powder, such as talc and a silica, or a multiple-valued carboxylic acid, a multiple-valued carboxylic acid and a sodium carbonate, or sodium bicarbonate, talc, a silica, a calcium carbonate, clay, a zeolite, an alumina, and a barium sulfate, a thermostabilizer, an ultraviolet ray absorbent, an antioxidant, a coloring agent, etc. are mentioned. Moreover, an antistatic agent and an antimicrobial agent may be blended.

[0026] 60% or more, as for the rate of a closed cell of the laminating foam in this invention, it is desirable that it is 70% or more, and it is still more desirable that it is especially 80% or more. When the rate of a closed cell becomes lower than 60%, there is a possibility that the rigidity of a foaming sheet and compressive strength may fall, for example, the physical reinforcement of the box which processes laminating foam and is obtained, a container, etc. may fall.

[0027] rate [of the laminating foam in this description] of closed cell: — S (%) — ASTM D — 2856 — 70 — indicating — having — ***** — a procedure — C — being based — Toshiba — Beckmann — incorporated company — make — air — relation — an aerometer — 930 — a mold — using it — measuring — having — a laminating — foam — truth — the volume — : — V_x — from — the following — (— ten —) — a formula — computing — having .

[0028]

[Equation 18]

$$S(\%) = (V_x - W/\rho) \times 100 / (V_a - W/\rho) \text{ — (10)}$$

[0029] However, in the above-mentioned (10) formula, V_x is the true volume (cm³) measured by the above-mentioned approach, and is equivalent to the sum of the volume of the resin which constitutes the laminating foam used for measurement, and the product of the closed cell part in the laminating foam used for measurement complete [cellular]. In addition, V_a , W , and ρ in the above-mentioned (10) types are as follows.

[0030] V_a : Apparent volume of the laminating foam calculated from the dimension of the laminating foam used for measurement (cm³)

W : total weight of the laminating foam used for measurement (g)

ρ : consistency of the resin which constitutes laminating foam (g/cm³)

In addition, the consistency ρ of the resin which constitutes laminating foam can perform actuation to which degassing of the air bubbles is carried out from this laminating foam with a heat press, and can ask for a consistency from the obtained sample.

[0031] In addition, since a test piece must be contained in the incompressible condition to the

set to 2.5cm and height may be set to 4cm, respectively, and the appearance volume makes it the thing of 3 25cm. However, when the thickness of laminating foam does not fulfill 4cm, two or more sheets are used as a test piece combining the test piece for measurement cut from this laminating foam so that 3 might be approached most 25cm.

[0032] As base material resin which constitutes synthetic-resin layers other than the outermost resin layer in this invention The same polypropylene resin and polyethylene system resin as a foaming sheet, others, In that the saponification object of the ethylene-vinyl acetate copolymer which has functionality, such as gas barrier nature, vinylidene chloride resin, polyamide resin, etc. are mentioned, and a foaming sheet, a polyolefine system resin layer, and fitness are pasted especially In order it is desirable to use the thing of the same kind which shows sufficient heat adhesive property as for the resin which constitutes this synthetic-resin layer, an outermost resin layer, and a foaming sheet and to obtain cheap laminating foam As for this synthetic-resin layer, it is more desirable to use what blended the base material resin of a foaming sheet and a recycle raw material of the same kind.

[0033] moreover, as base material resin which constitutes the outermost resin layer which constitutes all the synthetic-resin all [a part or] In that the same polypropylene resin as a foaming sheet and polyethylene system resin are mentioned, and a foaming sheet, or other synthetic-resin layers and fitness are pasted As for the resin which constitutes them, it is desirable to use the thing of the same kind which shows sufficient heat adhesive property, and in order to obtain cheap laminating foam, as for an outermost resin layer, it is more desirable to use what blended the base material resin of a foaming sheet and a recycle raw material of the same kind.

[0034] Moreover, adding additives, such as an antimicrobial agent and an elastomer, more than a kind to the base material resin which constitutes the synthetic-resin layer containing an outermost resin layer can make the laminating foam of this invention more functional.

[0035] Organic system drugs, such as inorganic system drugs, such as what supported the metal (ion) with antimicrobial activity, such as silver, copper, and zinc, to support as the above-mentioned antimicrobial agent, for example, a silver zeolite, a copper zeolite, a silver support phosphoric-acid zirconium, and silver support silica gel, an antimicrobial agent using the oxide system photocatalyst represented by anatase mold titanium oxide, a benzalkonium chloride, chlorination polyoxyethylene trialkylammonium, a polyhexamethylene biguanide hydrochloride, and chlorination 3-(trimethoxysilyl) propyldimethyloctadecyl ammonium, etc. are mentioned.

[0036] The consistency of the synthetic-resin layer containing the outermost resin layer in this invention is more than 300 (g/L) preferably, and consists of a consistency of base material resin, i.e., non-foaming resin, still more preferably. When the consistency of a synthetic-resin layer is more than 300 (g/L), the object disposition top effectiveness by carrying out the laminating of the synthetic-resin layer, the functional addition effectiveness, the improvement effectiveness in an appearance, etc. can be demonstrated.

[0037] In this description, measurement of the consistency of a synthetic-resin layer and the outermost resin layer in a synthetic-resin layer starts a resin layer to measure a consistency from laminating foam, and is called for by carrying out division process by the volume (L) called for from the dimension of the sample which started the started weight (g) of a sample.

[0038] As for the laminating foam of this invention, the outermost resin layer contains the polymer type antistatic agent (the so-called permanent antistatic agent), and the surface specific resistance of an outermost resin layer contains the antistatic agent polymer type [this] the 1×10^{13} (ohm/cm) following to the polyolefine system resin which constitutes an outermost resin layer so that it may become below 1×10^{11} (ohm/cm) still more preferably the 1×10^{12} (ohm/cm) following preferably. In addition, although especially the minimum of surface specific resistance is not limited, it is 1×10^8 (ohm/cm) in general.

[0039] It is thought that it does not demonstrate the antistatic effectiveness if it blends with polyolefine system resin simply and the polymer type antistatic agent is not arranged on a resin layer front face where it does not say that the antistatic effectiveness is demonstrated, the antistatic agent distributed in the shape of a muscle on the polyolefine system resin layer front

[0040] This network structure is easy to be formed by applying moderate orientation, in case an outermost resin layer is formed. Therefore, as for an outermost resin layer, from a viewpoint of forming the network structure, it is desirable to form by the extrusion lamination method or the heat lamination method.

[0041] On the other hand, a polymer type antistatic agent is very expensive, and the amount used is restricted in order to manufacture the product of a low price. Therefore, it is enough as a polymer type antistatic agent just to blend only with the outermost resin layer of laminating foam, and, as for this outermost resin layer, it is desirable to make it as thin as possible, to reduce the amount of resin, and to form by less than two or more basis weight 5 g/m² or less.

[0042] Thus, it is desirable to adopt a co-extrusion method from a viewpoint of forming the outermost resin layer which made it as thin as possible and reduced the amount of resin.

[0043] When surface specific resistance exceeds 1×10^{13} (Ω/cm), the antistatic effectiveness becomes inadequate, electrostatic charge is accumulated in the front face of laminating foam, and dust adheres.

[0044] Measurement of the surface specific resistance in this description is JIS fundamentally. It shall carry out based on K6911 (1995). Surface resistivity is measured and let the average of the obtained measured value be surface specific resistance, after cutting down three pieces of test pieces (100mm[100mm by] x thickness: test piece thickness) at equal intervals crosswise [vertical] to the direction of extrusion of a foaming sheet and specifically leaving a test piece under 23 degrees C and the ambient atmosphere of 50% of humidity from the obtained laminating foam for 24 hours. In addition, the above-mentioned measuring method is JIS. Although the condition was adopted in this description since condition adjustment of a test piece was to be performed based on K6911 (1995) by leaving it under 23 degrees C and the ambient atmosphere of 50% of humidity for 24 hours Since a polymer type antistatic agent is blended in this invention, the surface specific resistance which was not based on the conditions of neglect time amount or humidity, but was stabilized from immediately after laminating foam manufacture is shown. Therefore, even if it leaves the laminating foam of this invention on the above-mentioned conditions for 24 hours and does not carry out it, it demonstrates the outstanding effectiveness it is ineffective to the laminating foam which shows the same surface specific resistance as abbreviation.

[0045] in this description, the surface specific resistance of an outermost resin layer becomes below 1×10^{13} (Ω/cm) — as — **** — a polymer type antistatic agent forms structure like the network structure of fully demonstrating the antistatic engine performance, into the base material resin which constitutes an outermost resin layer structurally, and it means that static electricity can be conducted through this structure. When such structure is not formed, even if the polymer type antistatic agent is blended, it is difficult for surface specific resistance to obtain the outermost resin layer below 1×10^{13} (Ω/cm).

[0046] In this description, as for a polymer type antistatic agent, number average molecular weight shows at least 300–300000, and the thing of the resin with surface specific resistance smaller than 1×10^{12} ohms which is 600–15000 still more preferably preferably 300 or more. Moreover, the polymer type antistatic agent in this description may contain mineral salt or the low-molecular-weight organic proton acid salt 4, for example, LiClO₄, LiCF₃SO₃, NaClO₄, LiBF₄, NaBF₄, KBF₄ and KClO₄, KPF₃SO₃, calcium (ClO₄)₂ and Mg (ClO₄)₂, and Zn(ClO₄)₂ grade. In addition, the upper limit of the number average molecular weight of a polymer type antistatic agent is about 500000.

[0047] the above-mentioned molecular weight is conversion **** number average molecular weight (polystyrene reduced property) using the calibration curve obtained from the polystyrene of molecular-weight known using gel permeation chromatography.

[0048] In this description a polymer type antistatic agent specifically Polyethylene oxide, polypropylene oxide, a polyethylene glycol, A polyether, polyester amide, a polyether ester amide, One sort chosen from quarternary ammonium salt, such as ionomers, such as an ethylene-methacrylic-acid copolymer, and a polyethylene-glycol methacrylate system polymer, Or in a

of others further, such as them and polypropylene, etc. into a chain, it has a polar group and complexing or the resin which can carry out a solvation mentions mineral salt or a low-molecular-weight organic proton acid salt — having — mineral salt or an organic proton acid salt — complexing — or the solvation has been carried out. In addition, the upper limit of the melting point of a polymer type antistatic agent is 270 degrees C in general, and a minimum is 70 degrees C in general, and are 80–200 still more preferably 80–230 degrees C preferably. It becomes possible to form said good network structure comparatively easily, maintaining the basic physical properties of the base material resin with which an antistatic agent is added when the melting point of an antistatic agent chooses the thing of above-mentioned within the limits. Moreover, as for the crystallization temperature of a polymer type antistatic agent, it is desirable that it is the following ($T_c + 40$ degree C) on the basis of the crystallization temperature (T_c) of the base material resin which constitutes a polyolefine system resin foaming sheet. In addition, the minimum of the crystallization temperature of this antistatic agent is 60 degrees C in general. When the crystallization temperature of an antistatic agent chooses the thing of above-mentioned within the limits, and what was excellent in the antistatic effectiveness is obtained and it obtains the laminating foam of this invention especially by the co-extrusion method, what was excellent especially in the appearance is obtained.

[0049] The measuring method of the melting point of the resin which constitutes an antistatic agent or a resin layer in this description, and crystallization temperature is JIS. It is the value calculated by the thermal flux differential scanning calorimetry based on K7121–1987. About the detail of a Measuring condition, it carries out as follows.

Melting point: JIS The test piece which carried out condition adjustment of the test piece according to the conditions (a part for however, cooling rate/of 10 degrees C.) of the conditioning (2) of K7121–1987 and 3. test piece is used, and a fusion peak is acquired by carrying out temperature up in a part for 10-degree-C/. Let temperature of the top-most vertices of the acquired fusion peak be the melting point. In addition, when two or more fusion peaks appear, let temperature of the top-most vertices of a big fusion peak of area be the melting point most. However, when two or more big fusion peaks of area exist most, let the arithmetic mean value of the temperature of the top-most vertices of those fusion peaks be the melting point.

Crystallization temperature: JIS In the conditions of the conditioning (2) of K7121–1987 and 3. test piece, temperature of the top-most vertices of the exothermic peak obtained at the time of cooling rate the temperature fall for /of 10 degrees C is made into crystallization temperature. In addition, when two or more exothermic peaks appear, temperature of the top-most vertices of an exothermic peak with the biggest area is made into crystallization temperature. However, when two or more exothermic peaks with the biggest area exist, the arithmetic mean value of the temperature of the top-most vertices of those exothermic peaks is made into crystallization temperature.

[0050] What uses a polyether ester amide and a polyether as a principal component also especially in the antistatic agent of the polymer type used in this invention is desirable. These antistatic agents can demonstrate the antistatic effectiveness which was excellent, without being greatly influenced by the ratio of the melt flow rate of the base material resin of an outermost resin layer, and the melt flow rate of an antistatic agent. Furthermore, in order to acquire the effectiveness which controls the physical-properties lowering by adding the antistatic effectiveness and the antistatic agent which raised compatibility with the base material resin of an outermost resin layer to these antistatic agents, and were excellent in them, it is desirable to use for a polymer type antistatic agent mixing or the thing which carried out copolymerization for polyolefine system resin and a polyamide of the same kind. In addition, it means containing preferably considering as a principal component in this description at 85% of the weight or more of a rate still more preferably 75% of the weight or more 50% of the weight or more. Surface specific resistance can form easily the outermost resin layer below 1×10^{13} (Ω/cm^2) by forming the network structure etc. by the approach of mentioning later using these antistatic agents.

with the alkylene oxide addition product (2) of a polyamide (1) and bisphenols illustrated below.
[0052] A polyamide (1) is (a) lactam ring-opening-polymerization object, the polycondensation object of (b) amino carboxylic acid, or (c) dicarboxylic acid and the polycondensation object of diamine. As a lactam of (a), a caprolactam, an ENANTO lactam, a RAURO lactam, an undeca lactam, etc. are mentioned.

[0053] As an amino carboxylic acid of the above (b), omega-aminocaproic acid, omega-amino enanthic acid, omega-amino caprylic acid, omega-amino pel gon acid, omega-amino capric acid, 11-amino undecanoic acid, 12-amino dodecanoic acid, etc. are mentioned.

[0054] As dicarboxylic acid of the above (c), an adipic acid, an azelaic acid, a sebacic acid, a UNDEKANJI acid, a DODEKANJI acid, isophthalic acid, etc. are mentioned, and a hexamethylenediamine, heptamethylene diamine, octamethylene diamine, deca methylene diamine, etc. are mentioned as diamine.

[0055] Two or more kinds of things illustrated as the above-mentioned amide plasticity monomer may be used. A thing desirable [among these] is a caprolactam, 12-amino-dodecanoic-acid, and adipic-acid-hexamethylenediamine, and especially a desirable thing is a caprolactam.

[0056] As bisphenols of the alkylene oxide addition product (2) of said bisphenols, bisphenol A (4 and 4'-dihydroxydiphenyl -2, 2-propane), Bisphenol F (4 and 4'-dihydroxy diphenylmethane), Bisphenol S (4 and 4'-dihydroxy diphenylsulfone), 4, and 4'-dihydroxydiphenyl -2, 2-butane, etc. are mentioned, and among these especially a desirable thing is bisphenol A.

[0057] Moreover, as alkylene oxide of the alkylene oxide addition product (2) of said bisphenols, ethyleneoxide, propylene oxide, 1, and 2- or 1, 4-butylene oxide, and two or more kinds of such mixture are mentioned. A thing desirable [among these] is ethyleneoxide.

[0058] As for the melting point of the polyether ester amide which an outermost resin layer contains in this invention, it is desirable that it is 230 degrees C or less, and it is more desirable that it is 200 degrees C or less. Since temperature of both resin must be made high beyond the need in case polyolefine system resin and a polyether ester amide are fused and it mixes if this melting point exceeds 230 degrees C, there is a possibility that polyolefine system resin may deteriorate. Moreover, when carrying out a laminating by the co-extrusion method, although based also on the amount of laminatings of a resin layer, there is a possibility that a foaming sheet may become open cell structure and rigidity may fall.

[0059] When the melting point of a polyether ester amide is 200 degrees C or less, there is almost no possibility that the polyolefine system resin which constitutes an outermost resin layer may deteriorate, and even if it is the case where a laminating is carried out by the co-extrusion method, there is almost no possibility that a foaming sheet may become open cell structure and rigidity may fall.

[0060] The oxy-alkylene ether obtained as a polyether in this description by carrying out the addition reaction of the alkylene oxide to a phenols and a divinylbenzene addition polymer, b) Diglycidyl ether, such as an alkylene oxide addition product of polyoxy ethylene glycol, a polyoxypropylene glycol, a polyoxy butylene glycol, and bisphenols, The amine compound which has the aliphatic hydrocarbon radical of the carbon numbers 1-22 (preferably carbon numbers 6-22), such as hexyl, n-octyl, 2-ethylhexyl, nonyl, DESHIRU, dodecyl, tetradecyl, octadecyl, and oleyl one, Alkyl-sulfuric-acid ester, such as a dimethyl sulfate and a diethyl sulfate; Dimethyl carbonic acid, Alkyl carbonates, such as diethyl carbonic acid; Trimethyl phosphate, Alkyl benzyl chloride, benzyl chloride, alkyl chloride, The cation mold antistatic agent which is a reactant with the 4th class-ized agents, such as various phosphate, such as an alkyl star's picture, or halide, and consists of a compound which has two or more quarternary-ammonium-salt radicals in intramolecular is mentioned.

[0061] As the above-mentioned alkylene oxide, ethyleneoxide, propylene oxide, and butylene oxide are mentioned, and the copolymer of ethyleneoxide and ethyleneoxide, and propylene oxide is [among these] desirable. the number of addition mols of alkylene oxide — usually — 1-500 — it is 20-300 preferably and the oxy-alkylene content in the oxy-alkylene ether is 30 - 80 % of the weight more preferably 20 to 90% of the weight ten to 95% of the weight.

[0062] As the above-mentioned bisphenols, alkylene oxide addition products, such as bisphenol

Bisphenol S (4 and 4'-dihydroxy diphenylsulfone), 4, and 4'-dihydroxydiphenyl -2 and 2-butane, are mentioned.

[0063] Especially a desirable thing is the diglycidyl ether and such mixture of the glycidyl ether of polyoxy ethylene glycol, and the ethylene oxide addition product of bisphenols among the above-mentioned diglycidyl ether.

[0064] Especially a desirable thing is N-alkyl (carbon numbers 1-18) diethanolamine among the above-mentioned amine compounds.

[0065] Especially desirable things are a dimethyl sulfate and a diethyl sulfate among the above-mentioned 4th class-ized agents.

[0066] In order to acquire the effectiveness which controls the physical-properties lowering by adding the antistatic effectiveness and an antistatic agent excellent in the polyether ester amide or polyether mentioned above, it is more desirable that copolymerization of whether a polyamide, and the polyolefine system resin and the polyolefine system resin (number average molecular weight is denaturation polyolefine system resin of 800-25000 especially) of the same kind which constitutes the outermost resin layer are mixed is carried out. As a polyamide used here, the polyamide and copoly amide which were guided from diamine and dicarboxylic acid and/or the amino carboxylic acid, or the corresponding lactam are mentioned. Specifically A polyamide 4, a polyamide 6, polyamides 6/6, 6/10, 6/9, 6/12, 4/6, 12/12, a polyamide 11, a polyamide 12, the aromatic polyamide of meta xylene diamine and an adipic acid, From a hexamethylenediamine, isophthalic acid, and/or a terephthalic acid The polyamide and the above-mentioned polyamide which add an elastomer and are obtained if needed, and polyolefine, An olefin copolymer, an ionomer, or a copolymer with an elastomer, A polyamide or a copoly amide denatured by the block copolymer with a polyamide, a polyethylene glycol, a polypropylene glycol, or a polytetramethylene glycol, EPDM, or ABS is illustrated. The content of these polyolefine system resin and polyamides is 25 or less % of the weight still more preferably 25 or less % of the weight preferably 50 or less % of the weight. The antistatic effectiveness is not lost before and after ultrasonic cleaning according [what added the antistatic agent of the polymer type mentioned above] to the above-mentioned ethanol. Even if it, on the other hand, carries out bleed out of the case of the antistatic agent which consists of surface active agents, such as a mono-glycerol ester system, to a mold-goods front face, it incorporates the moisture in air and it demonstrates the antistatic effectiveness, the antistatic effectiveness will be lost after ultrasonic cleaning by the above-mentioned ethanol. Therefore, ultrasonic cleaning by the above-mentioned ethanol is effective as a means to distinguish the antistatic agent with which the antistatic agent added consists of polymer type an antistatic agent or a surfactant.

[0067] Moreover, the laminating foam of this invention has the operation from which surface specific resistance hardly changes before and after ultrasonic cleaning by ethanol with the value of 1×10^8 to 1×10^{13} (Ω/cm) within the limits by containing an antistatic agent in an outermost resin layer. Such laminating foam can be obtained by making said polymer type of antistatic agent contain as an antistatic agent. In this description, with in addition, ultrasonic cleaning by ethanol The test piece cut down from laminating foam is sunk into 23-degree C ethanol. After ultrasonic cleaning, Point out the actuation dried by leaving this test piece for 36 hours under the ambient atmosphere of the temperature of 30 degrees C, and 30% of relative humidity, and the surface specific resistance after ultrasonic cleaning by ethanol It is JIS except having considered as the test piece which carried out condition adjustment of the test piece immediately after this ultrasonic-cleaning actuation. It is measured based on K6911 (1995). In this invention, the addition of the antistatic agent in an outermost resin layer has 2 - 30 desirable % of the weight, its 5 - 25 % of the weight is more desirable, and its 10 - 20 % of the weight is still more desirable. When an addition is less than 2 % of the weight, and there is a possibility that the antistatic effectiveness may become inadequate and it exceeds 30 % of the weight, while there is a possibility that the formation of physical-properties lowering of an outermost resin layer or an outermost resin layer itself may become difficult, manufacture of cheap laminating foam becomes difficult.

[0068] The laminating foam of this invention consists of synthetic-resin layers which consist of

and this foaming sheet, as mentioned above. It is desirable that this synthetic-resin layer has an outermost resin layer more than consistency 300 (g/L) as an outermost layer of drum. The physical reinforcement of the box which can expect the reinforcement effectiveness by the synthetic-resin layer, processes laminating foam by this, and is obtained, a container, etc. improves, and as a tote box and a housing, it continues and can be used for a long period of time.

[0069] Furthermore, in the laminating foam of this invention, when a synthetic-resin layer consists of a polyolefine system resin layer of a monolayer, it is desirable that melt flow rate: X (g / 10 minutes) of the polyolefine system resin which constitutes this polyolefine system resin layer, basis weight: Y (g/m²) of this polyolefine system resin layer, and consistency: d (g/L) of a foaming sheet satisfy the relation of following the (1) - (4) type.

[0070] The consistency of a foaming sheet: When d , melt flow rate: X of the polyolefine system resin which constitutes this polyolefine system resin layer, and basis weight: Y of this polyolefine system resin layer are not filling the relation of following the (1) - (4) type, while excelling in physical reinforcement, such as rigidity and compressive strength, there is a possibility that surface specific resistance cannot obtain the laminating foam below 1×10^{13} (omega/**).

[0071]

[Equation 19] $Y \leq 0.27dX \dots (1)$

[0072] Basis weight of this polyolefine system resin layer : when Y (g/m²) exceeds the value computed by 0.27 ($m-2 \times L \times 10$ minutes, g-1), d (g/L), and X (g / 10 minutes) Under the conditions which can carry out laminating adhesion, the polyolefine system resin layer of basis weight Y and a melt flow rate X on the foaming sheet of a consistency d When the rate of a closed cell of the surface section of the foaming sheet with which the laminating of the polyolefine system resin layer is carried out falls, the physical properties of the laminating foam which the physical properties of a foaming sheet fall, consequently is obtained also fall remarkably. Moreover, the decline in the rate of a closed cell of a foaming sheet causes partial exfoliation of a polyolefine system resin layer. Since the decline in the rate of a closed cell of the above-mentioned foaming sheet has the too large heat capacity of the polyolefine system resin layer of softening in which a laminating is possible on a foaming sheet, or a melting condition, it is considered to be the result by which the cellular structure of a foaming sheet was destroyed with the heat. In addition, as for basis weight: Y (g/m²) of a polyolefine system resin layer, it is still more desirable that they are 0.23 or less dX s.

[0073]

[Equation 20] $2 \leq X \leq 40 \dots (2)$

[0074] The melt flow rate of the polyolefine system resin which constitutes a polyolefine system resin layer : when X is 2g / less than 10 minutes If the resin which constitutes a polyolefine system resin layer to the temperature which shows a good laminating adhesive property is heated when carrying out the laminating of the polyolefine system resin layer to a foaming sheet When there is a possibility that the heat capacity of this resin may become large and the rate of a closed cell of a foaming sheet may fall with the heat and it exceeds 40g / 10 minutes, there is a possibility that appearances, such as surface smooth nature, may become inadequate. in addition, melt flow rate: X of the polyolefine system resin which constitutes a polyolefine system resin layer — desirable — 5-40 (g / 10 minutes) — it is 8-40 (g / 10 minutes) still more preferably.

[0075]

[Equation 21] $5 \leq Y < 80 \dots (3)$

[0076] Basis weight of a polyolefine system resin layer: When Y is less than two 5 g/m, there is a possibility that formation of the polyolefine system resin layer which can fully demonstrate functions, such as antistatic engine performance and rigidity, may become difficult, and when Y is too large, there is a possibility that the lightweight nature of laminating foam may be lost. in addition, basis weight: Y of a polyolefine system resin layer — desirable — 5-40 (g/m²) — it is 5-30 (g/m²) still more preferably.

[0077]

[0078] The consistency of a foaming sheet: There is a possibility that physical reinforcement, such as low past rigidity and compressive strength, may be lost for a consistency when d is under 100 (g/L), and when exceeding 450 (g/L), there is a possibility that the lightweight nature of laminating foam may be lost. In addition, consistency: d of a foaming sheet is 120–300 (g/L) preferably.

[0079] The synthetic–resin layer in the laminating foam of this invention by constituting a synthetic–resin layer as a resin layer layered product more than the multilayer synthetic–resin layer which has a polyolefine system resin layer in an outermost layer of drum, i.e., two–layer By making only an outermost resin layer contain at worst functional additives which are excellent in especially physical reinforcement, such as rigidity, such as an effectiveness and polymer type antistatic agent, since the amount of the functional additive used can have the effectiveness of enough functional additives, such as the antistatic effectiveness, at least, it is desirable.

[0080] In the laminating foam to which the laminating of the synthetic–resin layer which consists of a two or more layers polyolefine system resin layer is carried out The basis weight of this synthetic–resin layer is [the basis weight of 80–380 (g/m²), and an outermost resin layer] under 80 (g/m²) more than five (g/m²). Consistency: d of a foaming sheet (g/L), The melt flow rate of the polyolefine system resin which constitutes inner layers other than an outermost resin layer (inner layer which consists of a polyolefine system resin layer more than one layer or two–layer) among the synthetic–resin layers which consist of this multilayer resin layer : X' (g / 10 minutes), Basis weight of this inner layer: It is desirable that Y' (g/m²) satisfies the relation of following the (5) – (8) type. In addition, there is a possibility that physical reinforcement, such as rigidity, may become inadequate when the basis weight of a synthetic–resin layer is under 80 (g/m²), and on the other hand, when the basis weight of a synthetic–resin layer exceeds 380 (g/m²), there is a possibility that the lightweight nature of laminating foam may be lost. Moreover, when the basis weight of an outermost resin layer is too small, there is possibility that neither the antistatic engine performance nor rigidity can fully be demonstrated. On the other hand, when the basis weight of an outermost resin layer exceeds 80 (g/m²), there is a possibility that the lightweight nature of laminating foam may become inadequate, and the amount of the functional additives used, such as an antistatic agent which adds functionality to laminating foam, will also increase.

[0081]

[Equation 23] $Y' \leq 0.27dX' \dots (5)$

[0082]

[Equation 24] $5 \leq X' \leq 40 \dots (6)$

[0083]

[Equation 25] $70 \leq Y' \leq 300 \dots (7)$

[0084]

[Equation 26] $100 \leq d \leq 450 \dots (8)$

[0085] When basis weight: Y' of this inner layer is made into less than two 70 g/m as semantics of the above–mentioned (5) – (8) type among the synthetic–resin layers which consist of a two or more layers polyolefine system resin layer, there is a possibility that the object of acquiring sufficient rigidity by carrying out the laminating of the multilayer synthetic–resin layer cannot be attained, and when Y' is too as large as 300 g/m², there is a possibility that the lightweight nature of laminating foam may be lost. Moreover, the melt flow rate of the polyolefine system resin which constitutes this inner layer: When X' is too small, the heat capacity at the time of laminating adhesion on the foaming sheet of a inner layer becomes large, and when there is a possibility that the rate of a closed cell of a foaming sheet may fall and X' exceeds 40 (g / 10 minutes), although based also on the basis weight of an outermost resin layer, there is a possibility that the poor appearance of laminating foam may occur. In addition, the semantics of the above (5) and (8) types is the same as that of the above (1) and (4) types.

[0086] in addition, basis weight: Y' (g/m²) of a inner layer — $0.23dX(s)'$ — it is still more desirable that it is the following. moreover, melt flow rate: X' of a inner layer — desirable — 8–40 (g / 10 minutes) — further — desirable — 10–40 (g / 10 minutes) — it is — basis weight: Y' of a inner

consistency: d of the above-mentioned foaming sheet is 120–300 (g/L) preferably.

[0087] the class of base material resin with which measurement of the melt flow rate of the resin layer in this description constitutes a resin layer — not being concerned — JIS A of K7210 (1999) — based on law, it shall measure by the test temperature of 230 degrees C, and 21.18 Ns of loads. In addition, when a synthetic-resin layer contains air bubbles, the melt flow rate of this synthetic-resin layer performs actuation to which degassing of the air bubbles is carried out from this synthetic-resin layer with a heat press, and asks for a melt flow rate from the obtained sample.

[0088] From the photograph which performed ten-point photography at equal intervals under the microscope, and photoed the thickness of the cross section of the cross direction of vertical laminating foam to the direction of extrusion of a foaming sheet, the basis weight of the resin layer in this description measures the thickness of each class, makes the arithmetic mean value of the obtained measured value the thickness of each class, it multiplies by the consistency of the base material resin which constitutes this resin layer in the thickness of a resin layer, and performs unit conversion and is calculated. When the resin layer contains the filler so much with a natural thing, it multiplies by the consistency of a filler content resin layer instead of the consistency of the base material resin of a resin layer, and unit conversion are performed, and the basis weight (g/m²) of a resin layer is calculated.

[0089] The consistency of the foaming sheet in this description: Measurement of d shall be performed as follows. By the approach beforehand mentioned above, the thickness of laminating foam and the thickness of a synthetic-resin layer are measured, and the basis weight of laminating foam is measured further. Let thickness which reduced the thickness of a synthetic-resin layer be the thickness of a foaming sheet from the thickness of the laminating foam for which it asked.

[0090] Next, the basis weight (g/m²) of a synthetic-resin layer is calculated by said approach. Next, let what reduced the basis weight of a synthetic-resin layer from the basis weight of said foaming layered product be the basis weight of a foaming sheet. The unit conversion of the value which \times (ed) basis weight (g/m²) of this foaming sheet by the thickness (mm) of the aforementioned foaming sheet are carried out, and it considers as the consistency (g/L) of a foaming sheet.

[0091] In the laminating foam of this invention, when it forms the good network structure that melt flow rate: β (g / 10 minutes) of the base material resin which an outermost resin layer is made to contain an antistatic agent, and constitutes melt flow rate: α (g / 10 minutes) of this antistatic agent and an outermost resin layer has satisfied the relation of following the (9) – (11) type, it is desirable. In addition, since it is difficult to form this network structure compared with other approaches when forming an outermost resin layer by the co-extrusion method, it is effective to satisfy the relation of following the (9) – (11) type especially. Moreover, also when making the synthetic-resin layers and foaming sheets other than an outermost resin layer contain an antistatic agent, as for the relation between melt flow rate: α of an antistatic agent, and the melt flow rate of the base material resin which constitutes this synthetic-resin layer and a foaming sheet, it is desirable to have satisfied the relation of following the (9) – (11) type like melt flow rate: β of the base material resin which constitutes an outermost resin layer.

[0092]

[Equation 27] $10 \leq \alpha \dots (9)$

[0093] The melt flow rate of an antistatic agent: When α is under ten (g / 10 minutes), there is a possibility that the viscosity of an antistatic agent may be too high that it stops to form the network structure of an antistatic agent. in addition, melt flow rate: α of an antistatic agent — further — it is desirable that it is 10–150 (g / 10 minutes). Even if the value of a melt flow rate α is a very big value, since it is usable, this antistatic agent moreover, in the case of an antistatic agent with a big melt flow rate. Although it may become difficult for the antistatic agent fused at the time of measurement of this melt flow rate to be discharged from the orifice of a measuring device within an instant, and to measure a melt flow rate to accuracy. When an

measurement count, the upper limit of this melt flow rate:alpha is 500 (g / 10 minutes) in general.

[0094]

[Equation 28] $2 \leq \beta \leq 40$ (10)

[0095] The melt flow rate of the base-material resin which constitutes an outermost resin layer etc.: When there is a possibility that the viscosity of an outermost resin layer may be too high that it stops to form the network structure of an antistatic agent when β is under two (g / 10 minutes) and it exceeds 40 (g / 10 minutes), there is a possibility that viscosity, such as an outermost resin layer, may be too low that it stops to form the network structure of an antistatic agent. in addition, melt flow rate: β of the base material resin which constitutes an outermost resin layer etc. — further — it is desirable 3–35 (g / 10 minutes), and that it is especially 8–35 (g / 10 minutes).

[0096]

[Equation 29] $0.5 \leq \alpha/\beta$ (11)

[0097] When α/β is less than 0.5, since the viscosity of an antistatic agent is too high, there is a possibility that it may become impossible to form the network structure of an antistatic agent, to the base material resin which constitutes an outermost resin layer etc. On the other hand, when α/β is too large, the viscosity difference of the base material resin which constitutes an antistatic agent, an outermost resin layer, etc. depending on the class of antistatic agent is too large, an antistatic agent condenses, and there is a possibility that it may become impossible to form the network structure of an antistatic agent. Moreover, especially when a polymer type antistatic agent is the thing of an ionomer system, it is desirable to make (α/β) or more into 2.5. in addition, the value of above-mentioned α/β — further — it is desirable 1–250, and that it is especially 1–150. Moreover, when the synthetic-resin layer consists of two or more layers, the melt flow rate of the base material resin which constitutes layers other than an outermost resin layer is desirable when a certain thing prevents the rate lowering of a closed cell of a foaming sheet the melt flow rate of the base material resin which constitutes an outermost resin layer, an EQC, or more than it. measurement of the melt flow rate of the antistatic agent in this description — the class of antistatic agent — not being concerned — JIS A of K7210 (1999) — based on law, it shall measure by the test temperature of 230 degrees C, and 21.18 Ns of loads In addition, in the case of the antistatic agent with which the melting point exceeds 230 degrees C, the relation of the above-mentioned (9) – (11) type is inapplicable.

[Translation done.]

*** NOTICES ***

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

EXAMPLE

[Example] An example explains this invention still more concretely.

[0099] The resin used for the example and the example of a comparison and an antistatic agent are shown below. In addition, in the following examples and the example of a comparison, a melt flow rate is only expressed as MFR.

[0100] Polypropylene-resin resin I: Grand Polymer company make and trade name J704U (propylene-ethylene block copolymer) (MFR:5g / , 10 minutes)

Resin II: Made in Sun Alomar, the recovery raw material of a trade name SD 632 (propylene system resin) (MFR:10g / , 10 minutes)

Resin III: Made in [Sun Alomar] and trade name PM870A (propylene-ethylene block copolymer) (MFR:17g / , 10 minutes)

Resin IV: Idemitsu Petrochemical company make, trade name J950H.P. (propylene-ethylene block copolymer) (MFR:32g / , 10 minutes)

Resin V: Idemitsu Petrochemical company make, trade name E200GP (propylene homopolymer) (MFR:2g / , 10 minutes)

Resin VI: Made in Sun Alomar, a trade name SD 632 (propylene system resin) (MFR:g [3.2g /], 10 minutes, crystallization temperature: 134 degrees C)

Resin VII: Idemitsu Petrochemical company make, trade name J750H.P. (propylene-ethylene block copolymer) (MFR:14g / , 10 minutes)

[0101] Polymer type antistatic-agent resin A: Product made from tiba SUPESHARUTI KEMIKARUZU, Inc., trade name IRGASTAT P18 (MFR:17g / , 10 minutes, melting-point:180 degree C, crystallization temperature: 143 degrees C) (polyether ester amide + polyamide)

Resin B: Product made from tiba SUPESHARUTI KEMIKARUZU, Inc., trade name IRGASTAT P22 (MFR:21g / , 10 minutes, melting-point:220 degree C, crystallization temperature: 172 degrees C) (polyether ester amide + polyamide)

Resin C: The Sanyo Chemical Industries, Ltd. make, the trade name JIEI stat 3180 (polyether ester amide) (MFR:g [70g /], 10 minutes, melting-point:160 degree C, crystallization temperature: 117 degrees C)

Resin D: Made in [E. I. du Pont de Nemours poly KEMIKARUZU, Inc.] Mitsui, a trade name SD 100 (ethylene system ionomer) (MFR:g [20g /], 10 minutes, melting-point:92 degree C, crystallization temperature: 64 degrees C)

Resin E: The Dai-Ichi Kogyo Seiyaku Co., Ltd. make, trade name LEO REXX AS 170 (quarternary-ammonium-salt radical content copolymer) (MFR:100g / 10 minutes or more, the melting point: 80 degrees C)

Resin F: The Sanyo Chemical Industries, Ltd. make, trade name PERESUTATTO 300 (polyether-polypropylene block copolymer) (MFR:100g / 10 minutes or more, melting-point:136 degree C, crystallization temperature: 81 degrees C)

[0102] Surface-active-agent system antistatic agent G: The Riken Vitamin Co., Ltd. make, a trade name S-100 (glycerol monostearate) (melting point: 65 degrees C)

Setting on these descriptions, the melting point of resin etc. is JIS. It is the thing of the melting out temperature called for based on K7121-1987. In addition, when two or more peaks appear in a DSC curve let top-most-vertices temperature of the largest peak of a peak area be the

melting point.

[0103] As the extruder for foaming sheet manufacture of examples 1, 2, 4-7, the example 1 of a comparison - 5 laminating foam, The tandem extruder which consists of two sets of extruders, the diameter of 90mm and the diameter of 120mm, is used. Synthetic-resin layers other than an outermost resin layer (it is hereafter called a inner layer.) The extruder with a diameter of 50mm was used as an extruder for formation, and the extruder with a diameter of 40mm was used as an extruder for outermost resin stratification, the laminating was carried out, and in order [of a foaming sheet, a inner layer, and an outermost resin layer] to carry out a co-extrusion, the annular die with a diameter [of 140mm] and a spacing of 1.0mm was used.

[0104] First, in order to form this foaming sheet, the polypropylene resin (resin VI) 100 weight section is received, 0.5 weight section combination of the cellular modifier (melting point: what blended the sodium-citrate 6 weight section to the low-density-polyethylene resin 100 weight section for MFR:5.4g / [109 degrees C and], and 10 minutes) is carried out. This polypropylene resin (resin VI) and a cellular modifier are supplied to the raw material input port of an extruder with a diameter of 90mm. Carry out heating kneading and consider as the melting resin mixture prepared by about 200 degrees C, and the mixed foaming agent which becomes this melting resin mixture from 70 % of the weight of normal butane and 30 % of the weight of isobutanes is pressed fit so that it may become the 1.2 - 2.8 weight section to the resin VI100 weight section. Subsequently, the extruder with a diameter of 120mm connected with the downstream of an extruder with a diameter [said] of 90mm was supplied, and fizz melting resin mixture was obtained.

[0105] The resin shown in the table 2 which constitutes a inner layer on the other hand was supplied to the extruder with a diameter of 50mm, melting kneading was carried out, and melting resin was obtained. Moreover, antistatic melting resin was obtained by carrying out melting kneading of the resin mixture of the resin and the antistatic agent which are shown in the table 2 which constitutes an outermost resin layer from an extruder with a diameter of 40mm. each fizz melting resin mixture, melting resin, and antistatic melting resin which were obtained are supplied into a unification die, and laminating unification of antistatic melting resin, the melting resin which constitutes a inner layer, and the fizz melting resin mixture is carried out — making — the co-extrusion from an annular die, and the outermost resin from an outside — the tubed laminating foam by which the laminating was carried out to the order of a layer / inner layer / foaming sheet / inner layer / outermost resin layer was formed. After clearing a tube-like object, having made the cylinder which had extruded tubed laminating foam cooled meet, and taking over, both sides of the laminating foam were heated and plate-ized with the heating furnace, and target laminating foam was obtained.

[0106] The class of resin which constitutes the inner layer and outermost resin layer of laminating foam in a table 2, MFR and laminating thickness were shown and MFR (X or X') of the polypropylene resin constituent layer which constitutes a resin layer, basis weight (Y or Y') and the thickness (mm) of laminating foam, (%) and the rate of a closed cell, surface specific resistance (ω /**), the surface specific resistance after ultrasonic cleaning (ω /**), and the consistency (g/L) of a foaming sheet were shown in a table 1. In addition, the surface specific resistance just behind extrusion foaming (surface specific resistance measured based on JIS K6911 (1995) except having considered as the test piece which carried out condition adjustment of the laminating foam just behind extrusion foaming (ω /**).) was also combined for reference, and it was shown in a table 2.

[0107] Example 3 inner layer was not prepared but laminating foam was obtained like the example 1 except having used the thing of the class shown in a table 2 as resin which constitutes an outermost resin layer. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0108] Only the foaming sheet was obtained like the example 1 without the example 8 and 9 unification die except it. Subsequently, the laminating of the resin mixture shown in a table 2 as an outermost resin layer was carried out to one side of this foaming sheet in the extrusion lamination by the T die, after that, front flesh-side reversal of the foaming sheet with which the

laminating of the outermost resin layer was similarly carried out to one side of another side in the T die. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0109] Laminating foam was obtained like the example 1 the increase of the addition of ten to example 13 foaming agent, and except having carried out and having made the consistency of a foaming sheet into 130 g/L. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0110] 14 to example 16 inner layer was not prepared, but the thing of the class shown in a table 2 as resin which constitutes an outermost resin layer was used, and laminating foam was obtained like the example 1 except having used the annular dice with a diameter of 98mm. However, plate-ization was not carried out but was rolled round in the shape of a roll as the electrical and electric equipment and a sheet for tray shaping for electronic-parts conveyance. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0111] Laminating foam was obtained like examples 14-16 except having used resin VI / resin VII=30 / 70 (weight ratio) (the crystallization temperature of resin VI / resin VII=30 / 70 (weight ratio) mixing resin having been 133 degrees C in addition.) for the polypropylene resin which constitutes an example 17 foaming sheet. The physical properties of the laminating foam obtained like the example 1 etc. were shown in tables 1 and 2.

[0112] Examples 1, 2, 4-7, 10-13, and the examples 1-5 of a comparison are laminating foam of five layer systems by which the laminating of a inner layer and the outermost resin layer was carried out to both sides of a foaming sheet, and examples 3, 8, 9, 14-17 are laminating foam of the three-tiered structure by which the laminating only of the outermost resin layer was carried out to both sides of a foaming sheet.

[0113]

[A table 1]

		樹脂			樹脂発泡体					製法
		MFR (X又はX') (g/10分)	坪量 (Y又はY') (g/m ²)	発泡シート 密度(d) (g/L)	厚み (mm)	泡立 気泡率 (%)	表面固有抵抗 (Ω/□)	押出発泡直後の 表面固有抵抗 (Ω/□)	超音波洗浄後の 表面固有抵抗 (Ω/□)	
実施例	1	5	175	225	3.1	87	1.5×10 ¹²	2.4×10 ¹²	2.8×10 ¹²	共押出(両面)
	2	10	135	130	4.0	85	6.6×10 ¹⁰	7.5×10 ¹⁰	7.0×10 ¹⁰	同上
	3	12	87	112	4.0	83	2.3×10 ¹¹	1.7×10 ¹¹	1.7×10 ¹¹	同上
	4	17	135	130	4.0	87	5.8×10 ¹¹	6.0×10 ¹¹	7.0×10 ¹¹	同上
	5	10	同上	130	4.0	73	3.2×10 ¹²	3.5×10 ¹²	3.2×10 ¹²	同上
	6	10	同上	130	4.0	83	4.3×10 ¹²	5.5×10 ¹²	6.0×10 ¹²	同上
	7	32	同上	130	4.0	87	3.2×10 ¹²	7.4×10 ¹²	8.2×10 ¹²	同上
	8	3	60	150	2.0	85	3.0×10 ¹²	2.0×10 ¹²	1.8×10 ¹²	押出ラミ(両面)
	9	同上	同上	150	2.0	85	6.5×10 ¹²	6.5×10 ¹²	6.0×10 ¹²	同上
	10	5	175	130	5.0	80	1.5×10 ¹²	2.1×10 ¹²	2.5×10 ¹²	共押出(両面)
	11	5	135	同上	4.0	82	9.5×10 ¹⁰	9.0×10 ¹⁰	9.0×10 ¹⁰	同上
	12	10	同上	同上	同上	85	6.7×10 ¹⁰	8.0×10 ¹⁰	7.5×10 ¹⁰	同上
	13	17	同上	同上	同上	87	4.4×10 ¹⁰	4.0×10 ¹⁰	5.1×10 ¹⁰	同上
	14	14	7	280	1.5	92	6.0×10 ¹¹	4.2×10 ¹¹	4.8×10 ¹¹	同上
	15	14	13	275	1.2	94	4.5×10 ¹¹	5.2×10 ¹¹	4.5×10 ¹⁰	同上
	16	14	25	280	2.0	80	8.5×10 ¹⁰	9.8×10 ¹⁰	1.2×10 ¹¹	同上
	17	14	13	275	1.2	93	4.2×10 ¹¹	5.1×10 ¹¹	5.9×10 ¹¹	同上
比較例	1	10	135	130	4.0	85	2.8×10 ¹²	5.0×10 ¹²	5.3×10 ¹²	共押出(両面)
	2	10	135	130	4.0	84	4.3×10 ¹²	5.0×10 ¹²	4.5×10 ¹²	同上
	3	32	同上	130	4.0	84	6.0×10 ¹²	6.6×10 ¹²	6.8×10 ¹²	同上
	4	10	同上	130	4.0	85	4.5×10 ¹²	4.1×10 ¹²	4.5×10 ¹²	同上
	5	10	同上	130	4.0	85	5.0×10 ¹²	4.2×10 ¹²	6.2×10 ¹²	同上

[0114]

[A table 2]

		最外樹脂層以外の合成樹脂層 (内層)			最外樹脂層			積層発泡体各層の質量 (最外樹脂層/内層/発泡シート/ 内層/最外樹脂層) (g/m ²)	
		種類	MFR (g/10分)	膜厚み (μm)	種類	帯電防止剤 添加量 (重量%)	MFR α/β (g/10分)		膜厚み (μm)
実 施 例	1	樹脂Ⅰ	5	194	樹脂A/樹脂Ⅰ	15	17/5	28	25/175/600/175/25
	2	樹脂Ⅱ*	10	150	樹脂A/樹脂Ⅱ	同上	17/10	同上	25/135/480/135/25
	3	—	—	—	同上	同上	同上	40	870/440/0/87
	4	樹脂Ⅲ	17	150	樹脂A/樹脂Ⅲ	同上	17/17	28	25/135/480/135/25
	5	樹脂Ⅱ*	10	同上	樹脂B/樹脂Ⅱ*	15	21/10	同上	同上
	6	樹脂Ⅱ*	同上	同上	樹脂C/樹脂Ⅱ	20	70/10	同上	同上
	7	樹脂Ⅳ	82	同上	樹脂C/樹脂Ⅳ	同上	70/82	同上	同上
	8	—	—	—	樹脂A/樹脂Ⅴ	15	17/2	55	80/0/280/0/80
	9	—	—	—	樹脂D/樹脂Ⅴ	20	80/2	同上	同上
	10	樹脂Ⅰ	5	194	樹脂A/樹脂Ⅰ	15	17/5	28	25/175/600/175/25
	11	樹脂Ⅱ*	5	150	樹脂F/樹脂Ⅰ	同上	100以上/5	同上	25/185/480/135/25
	12	樹脂Ⅱ*	10	同上	樹脂F/樹脂Ⅱ	同上	100以上/10	同上	同上
	13	樹脂Ⅲ*	17	同上	樹脂F/樹脂Ⅲ	同上	100以上/17	同上	同上
	14	—	—	—	樹脂F/樹脂Ⅶ	30	100以上/14	8	70/436/0/7
	15	—	—	—	樹脂F/樹脂Ⅶ	20	100以上/14	15	130/324/0/13
	16	—	—	—	樹脂F/樹脂Ⅶ	20	100以上/14	28	250/550/0/25
	17	—	—	—	樹脂F/樹脂Ⅶ	20	100以上/14	15	130/324/0/13
比 較 例	1	樹脂Ⅱ*	10	150	樹脂A/樹脂Ⅱ	1	17/10	28	25/135/480/135/25
	2	樹脂Ⅱ	10	150	樹脂D/樹脂Ⅱ	20	20/10	同上	25/135/480/135/25
	3	樹脂Ⅳ	82	同上	樹脂D/樹脂Ⅳ	同上	20/82	同上	同上
	4	樹脂Ⅱ	10	同上	樹脂E/樹脂Ⅱ	15	100以上/10	同上	同上
	5	樹脂Ⅱ*	同上	同上	G/樹脂Ⅱ*	0.8	—/10	同上	同上

*：熱可塑性エラストマー（エチレン-オクテンランダム共重合体、MFR=10.6g/10分）『ダウケミカル社製、

商品名：アフィニティーEG8200』を更に2.5重量%添加

[0115] It is shown on a chart by making a table 3 the consistency of a foaming sheet, the melt flow rate of a resin layer, the basis weight of a resin layer, and the numeric value of 0.27dX(s)' in the numeric value of dX(s) or the 0.27 aforementioned (5) type in the aforementioned (1) formula.

[0116]

[A table 3]

		MFR (X又はX') (g/10分)		発泡シート 密度(d) (g/L)	0.27dX 又は 0.27dX'	樹脂層の坪量 (Y又はY') (g/m ²)	
		X	X'			Y	Y'
実施例	1	—	5	225	304	—	175
	2	—	10	130	351	—	135
	3	12	—	112	363	37	—
	4	—	17	130	597	—	135
	5	—	10	130	351	—	135
	6	—	10	130	351	—	135
	7	—	32	130	1123	—	135
	8	3	—	150	122	50	—
	9	3	—	150	122	50	—
	10	—	5	130	176	—	175
	11	—	5	130	176	—	135
	12	—	10	130	351	—	135
	13	—	17	130	597	—	135
	14	14	—	290	1096	7	—
	15	14	—	275	1040	13	—
	16	14	—	280	1058	25	—
	17	14	—	275	1040	13	—
比較例	1	—	10	130	351	—	135
	2	—	10	130	351	—	135
	3	—	32	130	1123	—	135
	4	—	12	130	351	—	135

[Translation done.]